02-8902-16-PA
REV. NO. 0

FINAL DRAFT
PRELIMINARY ASSESSMENT
OXY PROCESS CHEMICALS, INC.
MORRISTOWN, NEW JERSEY

PREPARED UNDER

TECHNICAL DIRECTIVE DOCUMENT NO. 02-8902-16
CONTRACT NO. 68-01-7346

FOR THE

ENVIRONMENTAL SERVICES DIVISION
U.S. ENVIRONMENTAL PROTECTION AGENCY

MARCH 27, 1989

NUS CORPORATION
SUPERFUND DIVISION

SUBMITTED BY:

Charles LoBue
CHARLES LOBUE
PROJECT MANAGER

Gary Rojek
GARY ROJEK
SITE MANAGER

REVIEWED/APPROVED BY:

R M Naman
RONALD M. NAMAN
FIT OFFICE MANAGER

216978

POTENTIAL HAZARDOUS WASTE SITE PRELIMINARY ASSESSMENT

PART I: SITE INFORMATION

1. Site Name/Alias Oxy Process Chemicals, Inc./Diamond Shamrock Chemicals Co.

   Street 350 Mt. Kemble Avenue

   City Morristown State New Jersey Zip 07960

2. County Morris County Code 027 Cong. Dist. 11

3. EPA ID No. NJD052449022

4. Latitude 40° 46' 06" North Longitude 74° 30' 00" West

   USGS Quad. Mendham and Morristown

5. Owner Henkel Process Chemicals, Inc. Tel. No. (201) 267-1000

   Street 350 Mt. Kemble Avenue

   City Morristown State New Jersey Zip 07960

6. Operator Henkel Process Chemicals, Inc. Tel. No. (201) 267-1000

   Street 350 Mt. Kemble Avenue

   City Morristown State New Jersey Zip 07960

7. Type of Ownership

   ☒ Private ☐ Federal ☐ State

   ☐ County ☐ Municipal ☐ Unknown ☐ Other ____________

8. Owner/Operator Notification on File

   ☐ RCRA 3001 Date ________ ☐ CERCLA 103c Date ________

   ☐ None ☒ Unknown

9. Permit Information

Permit	Permit No.	Date Issued	Expiration Date	Comments
RCRA	NJD052449022	08/18/80	Unknown	TSDF
N.J. DEP Plant I.D. No.	25337	Unknown	Unknown	

10. Site Status

    ☒ Active ☐ Inactive ☐ Unknown

11. Years of Operation 1970 to Present

12. Identify the types of waste units (e.g., landfill, surface impoundment, piles, stained soil, above- or below-ground tanks or containers, land treatment, etc.) on site. Initiate as many waste unit numbers as needed to identify all waste sources on site.

(a) Waste Management Areas

Waste Unit No.	Waste Unit Type	Facility Name for Unit
1	Retention Basin	Lab Waste Retention Tank
2	Tank	Lab Retention Tank
3a	Containers	Solvent Storage
3b	Containers	Solid Waste Collection Area
3c	Containers	Solvent Storage Building

(b) Other Areas of Concern

Identify any miscellaneous spills, dumping, etc. on site; describe the materials and identify their locations on site.

There is no documentation of any spills or dumping having occurred on site.

13. Information available from

Contact Amy Brochu Agency U.S. EPA Tel. No. (201) 906-6802

Preparer Gary Rojek Agency NUS Corp. Region 2 FIT Date 03/17/89

PART II: WASTE SOURCE INFORMATION

For each of the waste units identified in Part I, complete the following six items.

Waste Unit 1 - Retention Basin , Lab Waste Retention Tank

1. **Identify the RCRA status and permit history, if applicable, and the age of the waste unit.**

   There were no known permits for this basin. This basin was in operation from 1971 to 1975. At present it is still located on site, but it is covered and not in use. The contents of the basin were removed in 1988.

2. **Describe the location of the waste unit and identify clearly on the site map.**

   The basin is located in the southern part of the property behind the fire road near the main building.

3. **Identify the size or quantity of the waste unit (e.g., area or volume of a landfill or surface impoundment, number and capacity of drums or tanks). Specify the quantity of hazardous substances in the waste unit.**

   The liquid volume of the basin is 911 ft^3. As recently as 1985 there was an unknown quantity of stagnant liquid and sediment in the basin. In 1988 the contents of the tank were sampled and evaluated as nonhazardous. They were then removed. Laboratory washwater flowed into the basin at a rate of 2 gallons/minute when it was in use.

4. **Identify the physical state(s) of the waste type(s) as disposed of in the waste unit. The physical state(s) should be categorized as follows: solid, powder or fines, sludge, slurry, liquid, or gas.**

   Liquid.

5. **Identify specific hazardous substance(s) known or suspected to be present in the waste unit.**

   Samples of stagnant water and sediment from the basin in 1985 contained the following contaminants: 0.067 ppm total cyanide; 3500 ppm Total Organic Carbon (TOC); 3.14 ppm total phenol; 120,000 ppm dry weight basis of petroleum hydrocarbons; and 0.602 ppm of barium.

6. **Describe the containment of the waste unit as it relates to contaminant migration via groundwater, surface water, and air.**

   The basin is lined with 12-inch-thick concrete, and it has approximately 4 feet of freeboard. Laboratory wash water flowed into this basin and was aerated, prior to being discharged into the sanitary sewer system.

Ref. Nos. 1, 2, 3, 4, 5, 6, 7, 8

PART II: WASTE SOURCE INFORMATION

For each of the waste units identified in Part I, complete the following six items.

Waste Unit 2 - Tank, Lab Retention Tank

1. **Identify the RCRA status and permit history, if applicable, and the age of the waste unit.**

   This tank was unpermitted. The age of the unit is unknown.

2. **Describe the location of the waste unit and identify clearly on the site map.**

   The lab retention tank was located near the solvent storage and solid waste collection area on the northern part of the property near Mt. Kemble Avenue.

3. **Identify the size or quantity of the waste unit (e.g., area or volume of a landfill or surface impoundment, number and capacity of drums or tanks). Specify the quantity of hazardous substances in the waste unit.**

   The capacity of the tank is unknown. The quantity of any hazardous substances in the tank is also unknown.

4. **Identify the physical state(s) of the waste type(s) as disposed of in the waste unit. The physical state(s) should be categorized as follows: solid, powder or fines, sludge, slurry, liquid, or gas.**

   The physical state of the waste is assumed to be liquid.

5. **Identify specific hazardous substance(s) known or suspected to be present in the waste unit.**

   Specific hazardous substances in the tank are unknown. This lab retention tank is part of the lab sink wash water collection system.

6. **Describe the containment of the waste unit as it relates to contaminant migration via groundwater, surface water, and air.**

   Wastes were contained in a tank prior to disposal into the lab sink wash water disposal system. This system eventually discharges into the sewer system. There is no history of any spills or leaks from this tank.

Ref. Nos. 2, 4, 5, 8

PART II: WASTE SOURCE INFORMATION

For each of the waste units identified in Part I, complete the following six items.

Waste Unit 3a, b, c - Containers , 3a) Solvent Storage
3b) Solid Waste Collection Area
3c) Solvent Storage Building

1. **Identify the RCRA status and permit history, if applicable, and the age of the waste unit.**

   In 1980 a RCRA Part A permit was filed for the storage of waste in drum containers for greater than 90 days. In 1986 the site was delisted as a TSD facility since waste was no longer stored for a period exceeding 90 days. The age of the drum storage areas is unknown. The site at present is inactive.

2. **Describe the location of the waste unit and identify clearly on the site map.**

   The solvent storage and solid waste collection areas are located in the northern part of the facility near Mt. Kemble Avenue. The solvent storage building is located in the southern part of the property near the application building.

3. **Identify the size or quantity of the waste unit (e.g., area or volume of a landfill or surface impoundment, number and capacity of drums or tanks). Specify the quantity of hazardous substances in the waste unit.**

   The drum containers had a total combined storage capacity of 5,500 gallons. The distribution of these drums and the number in each individual storage area are unknown.

4. **Identify the physical state(s) of the waste type(s) as disposed of in the waste unit. The physical state(s) should be categorized as follows: solid, powder or fines, sludge, slurry, liquid, or gas.**

   Liquids and solids were stored in the drums.

5. **Identify specific hazardous substance(s) known or suspected to be present in the waste unit.**

   The following compounds are known or suspected to have been stored in containers in the three storage areas:

acetone	naphthalene
1-butanol	nitrobenzene
chloroform	2-propenamide
4-chloro-m-cresol	2-propenic acid
cresols	phenol
dichloromethane	sodium cyanide
isobutyl alcohol	thiourea
maleic anhydride	toluene
methanol	toluenediisocyanate
methyl ethyl ketone	1,1,1-trichloroethane
methyl isobutyl ketone	trichloroethene
methylene oxide	xylene

6. Describe the containment of the waste unit as it relates to contaminant migration via groundwater, surface water, and air.

Waste was stored in drum containers on a cement pad in all three storage areas. Each area was fenced and covered with a roof. There is no history of any spills having occurred in any of the storage areas.

Ref. Nos. 5, 7, 8, 9

PART III: HAZARD ASSESSMENT

GROUNDWATER ROUTE

1. **Describe the likelihood of a release of contaminant(s) to the groundwater as follows: observed, alleged, potential, or none. Identify the contaminant(s) detected or suspected, and provide a rationale for attributing the contaminant(s) to the facility.**

   There is no potential for groundwater contamination. The lab waste retention tank is lined with 12-inch-thick concrete, and there is adequate freeboard. The remainder of the laboratory wash water was contained in another lab retention tank prior to being emptied into the sewer system. The drum storage areas are all concrete-lined and roofed, and there is no history of spills.

   Ref. Nos. 2, 5, 6, 7

2. **Describe the aquifer of concern; include information such as depth, thickness, geologic composition, permeability, overlying strata, confining layers, interconnections, discontinuities, depth to water table, groundwater flow direction.**

   The aquifer of concern is the Brunswick Formation. It is a part of, and interconnected with, the Buried Valley Aquifer System of northern New Jersey. The Brunswick Formation is a bedrock aquifer composed of interbedded brown, reddish-brown, and gray shale, sandy shales, sandstone, and some conglomerate. In the area of the site it is located at a depth of 220 feet below the ground surface and probably exceeds 6,000 feet in thickness. It is overlain with unconsolidated sand, clay, and gravel deposits of glacial, fluvial, and lacustrine origin of Pleistocene and Holocene age. Groundwater flow is generally from topographically high areas toward areas of discharge in the valleys. The groundwater flow in the area near the site is unknown, but may be assumed to be in a generally southeasterly direction toward the Chatham Valley.

   Ref. Nos. 10, pp. 1-8; 11 pp. 14-17, 28-36, 77-78, 104, 129-130

3. **Is a designated sole source aquifer within 3 miles of the site?**

   The Buried Valley Aquifer System is a sole source aquifer.

   Ref. No. 11, pp. 3-4

4. **What is the depth from the lowest point of waste disposal/storage to the highest seasonal level of the saturated zone of the aquifer of concern?**

   The depth from the bottom of the lab waste retention basin to the highest seasonal level of the saturated zone of the Brunswick Formation is 17.5 feet. (The altitude of the retention basin is 320 feet, and the altitude of the water level in the nearest well is 296.5 feet). A depth of 6 feet is assumed for the basin, since the actual depth is not known.

   Ref. Nos. 12, 13, 14

5. **What is the permeability value of the least permeable continuous intervening stratum between the ground surface and the aquifer of concern?**

   The permeability value of the unconsolidated sand, clay, and gravel deposits overlying the Brunswick Formation is greater than 10^{-7} cm/sec.

   Ref. Nos. 10, 11, 12

6. **What is the net precipitation for the area?**

   15 inches.

   Ref. Nos. 12, 13

7. **Identify uses of groundwater within 3 miles of the site (i.e., private drinking source, municipal source, commercial, industrial, irrigation, unusable).**

Groundwater is a source of municipal drinking water and is also used for industrial purposes.

Ref. Nos. 10, 11

8. **What is the distance to and depth of the nearest well that is currently used for drinking or irrigation purposes?**

Distance 0.5 mile south of the site **Depth** 94 feet

Ref. Nos. 12, 15

9. **Identify the population served by the aquifer of concern within a 3-mile radius of the site.**

The Morristown Water Company has wells drawing water from the aquifer of concern which serve approximately 16,600 people. The East Hanover Water Department is also connected to the Morristown Water Company, and it serves approximately 7,400 people.

Ref. Nos. 11 pp. 135-136; 12; 15; 16

SURFACE WATER ROUTE

10. **Describe the likelihood of a release of contaminant(s) to surface water as follows: observed, alleged, potential, or none. Identify the contaminant(s) detected or suspected, and provide a rationale for attributing the contaminants to the facility.**

There is no potential for contaminants to be released into surface water. The lab waste retention basin has adequate freeboard and is presently covered. Its contents have been removed. The lab retention tank is not in use. Drums are present in the storage areas, but they are on cement pads and are in structures that are roofed. The site is relatively flat; there is a drainage ditch on site which appears to be connected with the sewer system.

Ref. Nos. 2, 4, 7, 17

11. **Identify and locate the nearest downslope surface water. If possible, include a description of possible surface drainage patterns from the site.**

The nearest downslope surface water is an unidentified stream which flows south into a freshwater wetland. The site topography is relatively flat, sloping gradually to the stream west of the facility.

Ref. No. 15

12. **What is the facility slope in percent? (Facility slope is measured from the highest point of deposited hazardous waste to the most downhill point of the waste area or to where contamination is detected.)**

The facility slope is less than 3 percent. $\left(\frac{380 \text{ feet} - 320 \text{ feet}}{2500 \text{ feet}} \times 100\right)$

Ref. No. 15

13. **What is the slope of the intervening terrain in percent? (Intervening terrain slope is measured from the most downhill point of the waste area to the probable point of entry to surface water.)**

The slope of intervening terrain is 1 percent $\left(\frac{320 \text{ feet} - 300 \text{ feet}}{2100 \text{ feet}} \times 100\right)$

Ref. No. 15

14. **What is the 1-year 24-hour rainfall?**

3 inches.

Ref. No. 13

15. **What is the distance to the nearest downslope surface water? Measure the distance along a course that runoff can be expected to follow.**

    The distance is 2100 feet from the solvent storage building to the unidentified stream.

    Ref. No. 15

16. **Identify uses of surface waters within 3 miles downstream of the site (i.e., drinking, irrigation, recreation, commercial, industrial, not used).**

    The surface water within 3 miles downstream of the site is not used. The unidentified stream flows into freshwater wetlands south of the site.

    Ref. Nos. 15, 16

17. **Describe any wetlands, greater than 5 acres in area, within 2 miles downstream of the site. Include whether it is a freshwater or coastal wetland.**

    Freshwater wetlands covering an area of approximately 55 acres lie approximately 0.6 mile downstream of the site.

    Ref. No. 15

18. **Describe any critical habitats of federally listed endangered species within 2 miles of the site along the migration path.**

    There are no known critical habitats of federally listed endangered species within 2 miles of the site along the migration pathway.

    Ref. Nos. 15, 18

19. **What is the distance to the nearest sensitive environment along or contiguous to the migration path (if any exist within 2 miles)?**

    A freshwater wetland lies 0.6 mile downstream of the migration pathway from the site.

    Ref. No. 15

20. **Identify the population served or acres of food crops irrigated by surface water intakes within 3 miles downstream of the site and the distance to the intake(s).**

    None.

    Ref. Nos. 15, 16

21. **What is the state water quality classification of the water body of concern?**

    The unidentified stream flows into wetlands which in turn drain into the Great Brook. The unidentified stream would have the same state water quality classification as the Great Brook, which is FW2-NT.

    Ref. No. 19

22. **Describe any apparent biota contamination that is attributable to the site.**

    None known.

    Ref. No. 17

AIR ROUTE

23. **Describe the likelihood of a release of contaminant(s) to the air as follows: observed, alleged, potential, none. Identify the contaminant(s) detected or suspected, and provide a rationale for attributing the contaminant(s) to the facility.**

    There is no potential for a release of contaminants to the air. Contaminants are contained in drums or a tank, and the lab waste retention basin is covered.

    Ref. Nos. 4, 5, 17

24. What is the population within a 4-mile radius of the site?

Approximately 41,000.

Ref. No. 20

FIRE AND EXPLOSION

25. Describe the potential for a fire or explosion to occur with respect to the hazardous substance(s) known or suspected to be present on site. Identify the hazardous substance(s) and the method of storage or containment associated with each.

There is little potential for a fire or explosion to occur with respect to the hazardous substances stored on site. All ignitable or reactive wastes are stored in drums in sound storage areas with no record of spills. The contents of the lab waste retention tank have been removed. At present, the lab retention tank is also empty. This system is connected to the lab sink wash water retention system.

Ref. Nos. 4, 5, 17

26. What is the population within a 2-mile radius of the hazardous substance(s) at the facility?

Approximately 4,200.

Ref. No. 20

DIRECT CONTACT/ON-SITE EXPOSURE

27. Describe the potential for direct contact with hazardous substance(s) stored in any of the waste units on site or deposited in on-site soils. Identify the hazardous substance(s) and the accessibility of the waste unit.

There is little potential for direct contact with any wastes stored on site. Drums are kept in storage areas which are enclosed or fenced. The lab waste retention basin is covered and also fenced; its contents have been removed.

Ref. Nos. 4, 5, 17

28. How many residents live on a property whose boundaries encompass any part of an area contaminated by the site?

None.

Ref. Nos. 15, 17

29. What is the population within a 1-mile radius of the site?

Approximately 1400.

Ref. No. 20

PART IV: SITE SUMMARY AND RECOMMENDATIONS

The Oxy Process Chemicals, Inc. Site is a former laboratory research facility which covers an area of approximately 65 acres in Morristown, Morris County, New Jersey. It is located in an industrial area surrounded by residential areas. An unnamed stream lies approximately 1000 feet west of the property boundary. This stream flows into wetlands south of the site. These wetlands eventually drain into the Great Brook. The privately owned facility has undergone several name and ownership changes during the past 6 years. It was originally called Diamond Shamrock Chemicals Corporation when the facility came into existence in 1970. In August 1986, the name was changed to Oxy Process Chemicals, Inc. In June 1987, the facility ownership changed hands and it became Henkel Process Chemicals, Inc. Present plans call for the closure of this facility in April 1989, with the transfer of laboratory processes to a new location in Pennsylvania.

In 1980 as Diamond Shamrock Chemicals Corporation, the facility filed for a RCRA Part A permit for greater than 90 days' storage of hazardous waste in drum containers. In April 1986, the facility was delisted by the New Jersey Department of Environmental Protection (NJDEP) from Treatment, Storage, Disposal (TSD) status to hazardous waste generator status for less than 90 days storage.

Most of the waste on site pertained to the storage of various industrial organic chemicals in drum containers at three storage areas. All of the drums were stored in roofed sheds with cement floors, or in enclosed structures, and each area was secure. Presently, during the closure of the facility, the drums are being removed from the storage areas. There is no history of any spills from any of the drums stored on site. The remaining waste units are tied into the laboratory sink wash water disposal system. Laboratory wash water was retained in the lab retention tank and in the lab waste retention tank prior to discharge into the sewer system of the facility. Records indicate that these tanks have not been in use since 1975. The remaining sediment in the lab waste retention tank was sampled in 1985, and analysis revealed the presence of a semivolatile compound, petroleum hydrocarbons, total organic carbon, total cyanide, and an inorganic chemical. Additional sampling of the tank contents was conducted by a contractor to Oxy Process Chemicals, Inc. in 1988. This sampling was conducted as part of the Environmental Cleanup Responsibility Act (ECRA) requirements for the transfer of the property to Henkel Process Chemicals, Inc. The results of this sampling revealed that the contents of the tank were not hazardous and that no contamination was found near the drum storage areas. The only record of enforcement actions against the facility was in 1986 for failure to segregate containerized hazardous waste by waste type in the drum storage areas.

At present there is little potential for the migration of contaminants into the environment. All waste is stored in drums which are kept on cement pads in well-maintained storage areas, which are roofed and fenced. There is no record of any spills from the drums. The lab retention tank and lab waste retention tank are presently not in use, and the contents of the lab waste retention tank have been removed. In addition, the lab waste retention tank, which was an open basin, is lined with 12-inch-thick concrete and has adequate freeboard. It is presently covered. There is little potential for direct contact with any remaining waste on site.

Due to these factors, the recommendation for this site is that there be **NO FURTHER REMEDIAL ACTION PLANNED (NFRAP).**

REFERENCES

1. Letter from Conrad Simon, Director, Air and Waste Management Division, U.S. EPA, to Ms. Sandra J. Schillon, Plant Coordinating Supervisor, Diamond Shamrock Corp., May 28, 1986.

2. Letter from Paul J. Dugas, Senior Environmental Engineer, Diamond Shamrock Chemicals Company, to Mr. R.A. Baker, Permits Administration Branch, U.S. EPA, June 27, 1986.

3. Letter from P.J. Dugas, Senior Environmental Engineer, Diamond Shamrock Chemicals Company, to Mr. R.A. Baker, Chief, Permits Administration Branch, U.S. EPA, August 15, 1986.

4. Telecon Note: Conversation between Edward Clancy, Lab Supervisor, Henkel Process Chemicals, Inc., and Gary Rojek, NUS Corp. March 16, 1989.

5. RCRA permit application, Diamond Shamrock Corp., EPA I.D. Number NJD052449022, November 13, 1980.

6. Letter from Gary J. Shelby, P.E., Environmental Engineer, Henkel Corp., to Mr. Ernest J. Kulwein, Jr., New Jersey Department of Environmental Protection (NJDEP), Division of Hazardous Waste Management, June 1, 1987.

7. Environmental Protection Agency, Hazardous Waste Permit Application, Consolidated Permits Program, Form 3 RCRA, Section VI Photographs, October 28, 1980.

8. Telecon Note: Conversation between Mark Meyer, NJDEP, Industrial Site Evaluation, and Gary Rojek, NUS Corp. March 17, 1989.

9. Letter from Frank Coolick, Chief, NJDEP, Bureau of Hazardous Waste Engineering, to Hadley Bedbury, Diamond Shamrock Chemicals Company, April 23, 1986.

10. Meisler, H., Computer Simulation Model of the Pleistocene Valley - Fill Aquifer in Southwestern Essex and Southeastern Morris Counties, New Jersey, U.S. Geological Survey, Water Resources Investigations 76-25, May 1976.

11. Passaic River Coalition, Daniel J. Vans Abs, Ph.D., Project Director, The Buried Valley Aquifer Systems: Resources and Contamination, 1986.

12. Selected Information of Wells from the Groundwater Site Inventory Data Base, Morris County, New Jersey, U.S. Geological Survey, Trenton, New Jersey, January 13, 1986.

13. Uncontrolled hazardous waste site ranking system, A user's manual, 40 CFR, Part 300, Appendix A, 1986.

14. Telecon Note: Conversation between Peter Badaicho, Morristown Water Dept. and John Harrison of NUS Corp., March 15, 1989.

15. Three-Mile Vicinity Map, based on U S. Department of the Interior, Geological Survey, Topographic Maps, 7.5 minute series, "Morristown Quadrangle, N.J." 1954, photorevised 1981; "Mendham Quadrangle, N.J." 1954, photorevised 1981; "Chatham Quadrangle, N.J." 1955, photorevised 1981; and "Bernardsville Quadrangle, N.J." 1954, photorevised 1981.

16. NJDEP, Water Supply Overlay Map, Sheet 25, August 1975.

REFERENCES (Cont'd)

17. Preliminary Assessment Off-Site Reconnaissance Information Reporting Form, Oxy Process Chemicals, Inc., TDD No. 02-8902-16, NUS Corp., Region 2 FIT, February 20, 1989.

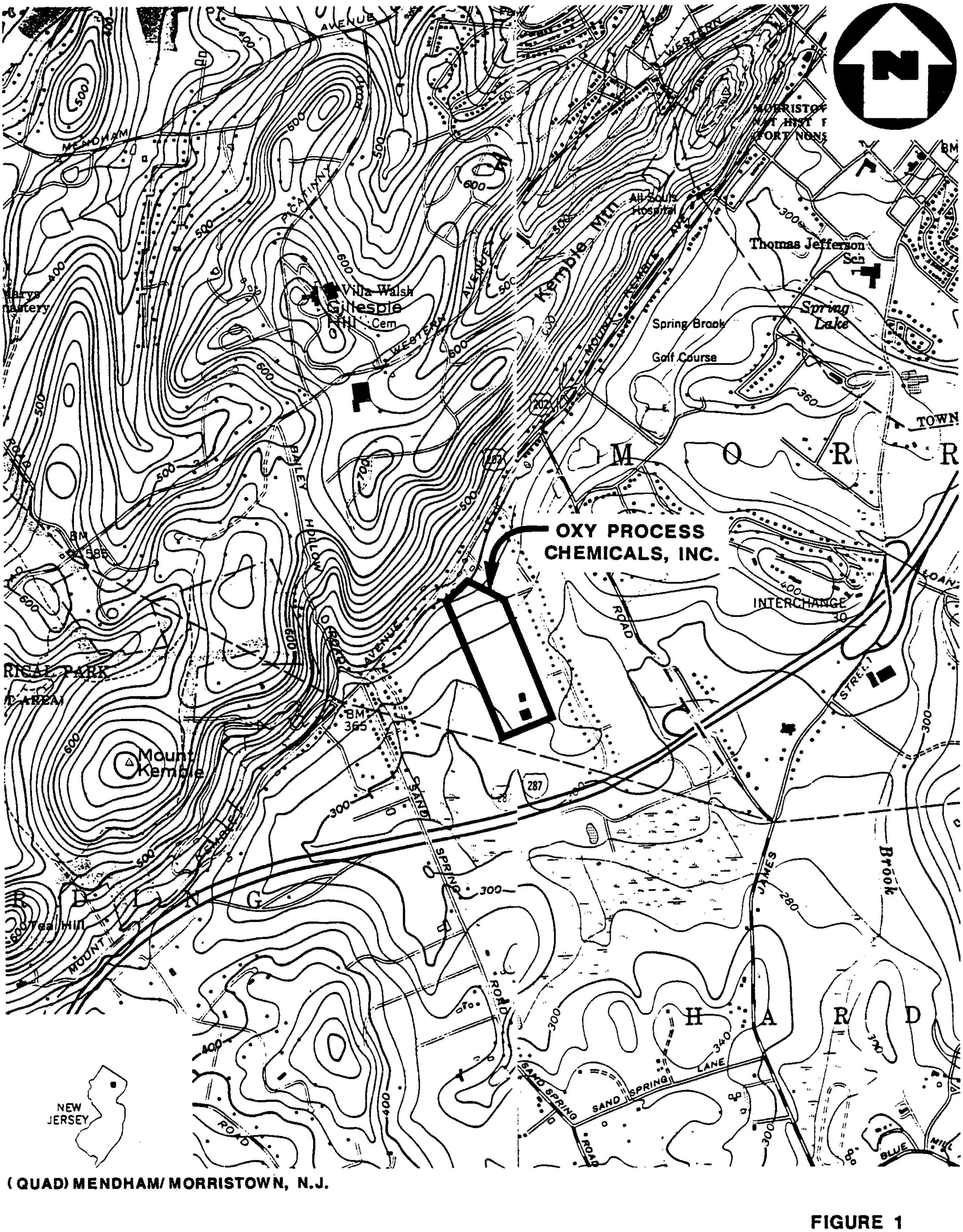
18. Atlantic Coast Ecological Inventory, 1:250,000 scale map, Newark, N.J.-N.Y.-PA., U.S. Fish and Wildlife Service, 1980.

19. NJDEP Division of Water Resources, Surface Water Quality Standards, N.J.A.C. 7:9-4, May 1985.

20. General Sciences Corporation, Graphical Exposure Modeling System, Landover, Maryland, 1986.

ATTACHMENT A

MAPS AND PHOTOS



(QUAD) MENDHAM/ MORRISTOWN, N.J.

FIGURE 1

SITE LOCATION MAP

OXY PROCESS CHEMICALS, INC., MORRISTOWN, N.J.

NUS CORPORATION

SCALE: 1" = 2000'

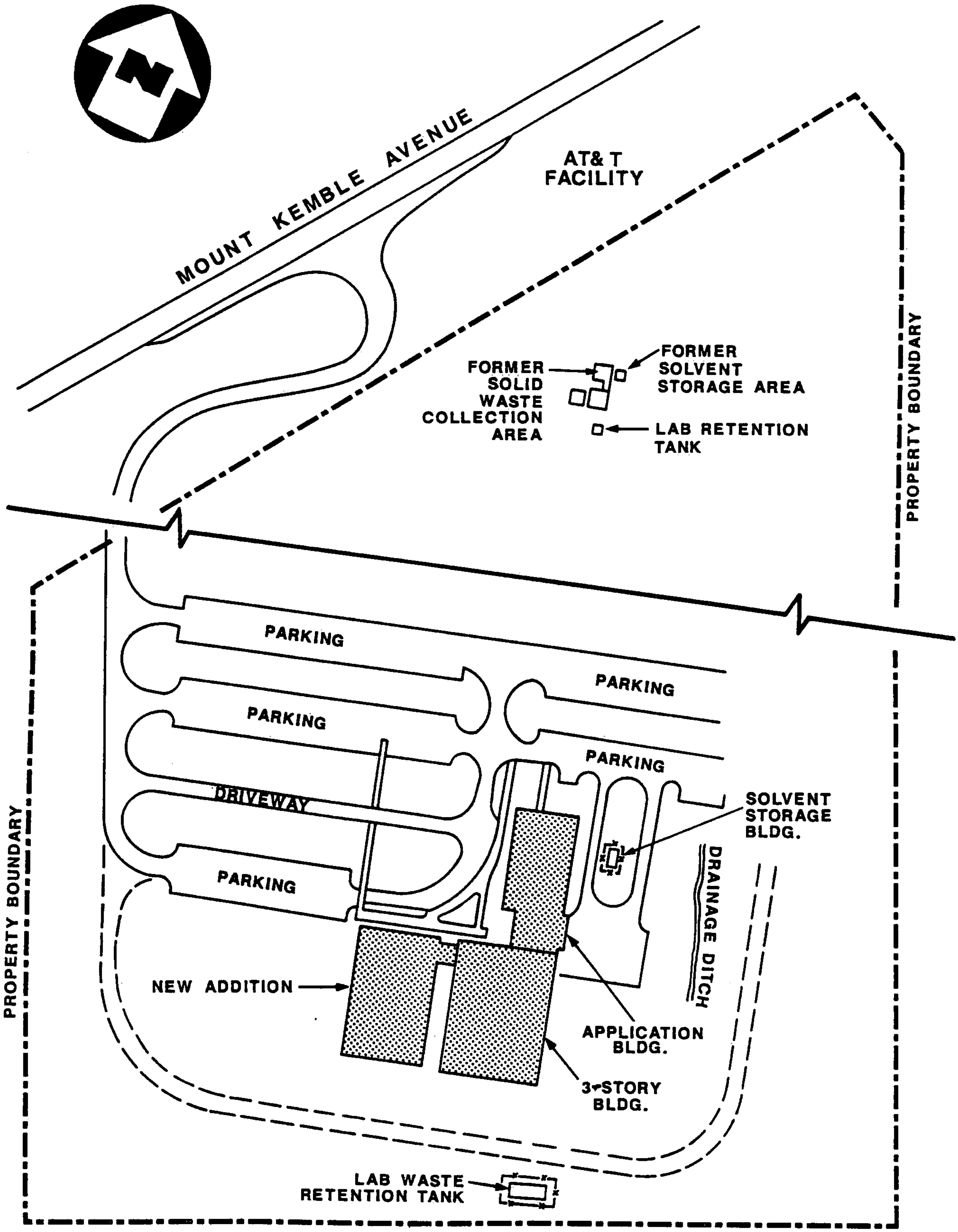


FIGURE 2

SITE MAP
OXY PROCESS CHEMICALS, INC., MORRISTOWN, N.J.

NOT TO SCALE

NUS CORPORATION

PHOTOGRAPH LOG

OXY PROCESS CHEMICALS, INC.
MORRISTOWN, NEW JERSEY

SITE RECONNAISSANCE: FEBRUARY 20, 1989

OXY PROCESS CHEMICALS, INC.
MORRISTOWN, NEW JERSEY
FEBRUARY 20, 1989
PHOTOGRAPH INDEX

Photo Number	Description	Time
1P-1	Viewing direction southwest; solvent storage area.	1020
1P-2	Viewing direction south; loading dock and background.	1020
1P-3	Viewing direction south; drainage ditch.	1023
1P-4	Drums in solvent storage area.	1024
1P-5	Viewing direction southeast.	1027
1P-6	Pictures of buildings; western border.	1027
1P-7	Sign post of Henkel.	1030
1P-8	Unknown fenced-in structure at southern border.	1031

All photographs were taken by Valerie Mathers.

OXY PROCESS CHEMICALS, INC.
MORRISTOWN, NEW JERSEY

1P-3 February 20, 1989 1023
Viewing direction south; drainage ditch.

1P-4 February 20, 1989 1024
Drums in solvent storage area.

OXY PROCESS CHEMICALS, INC.
MORRISTOWN, NEW JERSEY

1P-1 February 20, 1989 1020
Viewing direction southwest; solvent storage area.

1P-2 February 20, 1989 1020
Viewing direction south; loading dock and background.

OXY PROCESS CHEMICALS, INC.
MORRISTOWN, NEW JERSEY

1P-5 February 20, 1989 1027
Viewing direction southeast.

1P-6 February 20, 1989 1027
Pictures of buildings; western border.

ATTACHMENT B

REFERENCES

REFERENCE NO. 1

L. Livingston

MAY 28 1986

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Ms. Sandra J. Schillon
Plant Coordinating Supervisor
Diamond Shamrock Corporation
350 Mount Kemble Avenue
Morristown, New Jersey 07960

Re: RCRA Inspection (February 14, 1986)
Diamond Shamrock Corporation
EPA I.D. No. NJD052449022

Dear Ms. Schillon:

The United States Environmental Protection Agency (EPA) regulates the handling of hazardous waste under the Resource Conservation and Recovery Act (RCRA), as amended, 42 U.S.C. §6901 et seq.

In accordance with EPA's authority, an inspection was performed on or about February 14, 1986, at this facility by a duly authorized representative of EPA pursuant to Section 3007 RCRA. The above referenced inspection revealed that your facility was using a retention basin for aeration of hazardous waste.

Section 3007 of RCRA, 42 U.S.C. §6927, also allows EPA to request certain information from parties who handle or have handled hazardous waste. Pursuant to the provisions of this Section, we hereby require that you provide the information detailed in Attachment I. Your reply must be completed and signed by a responsible official of your company and must be returned within 30 calendar days of the date of your receipt of this letter.

Your response to the request in Attachment I should be mailed to the following addressee:

Samuel I. Ezekwo, Environmental Engineer
Solid Waste Branch
Air & Waste Management Division
U.S. Environmental Protection Agency
Region II
26 Federal Plaza, Room 1006
New York, New York 10278

Richard S. Baker, Chief
Permits Administration Branch
U.S. Environmental Protection Agency
Region II
26 Federal Plaza, Room 432
New York, New York 10278

Your failure to respond to this letter truthfully and accurately within the time provided, may subject you to an enforcement action under Section 3008 of RCRA, 42 U.S.C. §6920. Such enforcement action may include the assessment of substantial penalties of up to $25,000 per day for continued noncompliance. This information request meets the requirements of the Paperwork Reduction Act of 1980, 44 U.S.C. §3501 et seq.

You may, if you so desire, assert a business confidentiality claim covering all or part of the information herein requested. The claim may be asserted by placing on (or attaching to) the information, at the time it is submitted, a cover sheet, stamped or typed legend, or other suitable form of notice employing language such as "trade secret," or "proprietary," or "company confidential." Information covered by such a claim will be disclosed by EPA only to the extent and by means of procedures set forth in 40 CFR Part 2. If no such claim accompanies the information when it is received by EPA, it may be made available to the public by EPA without further notice to you.

If you have any questions about this letter, you may call Samuel I. Ezekwo, of my staff, at (212) 264-6141.

Sincerely yours,

Conrad Simon
Director
Air & Waste Management Division

Enclosure

bcc: S. ~~Ezekwo~~, 2AWM-SW
L. ~~Livingston~~, 2OPM-PA
C. ~~Amos~~, 2AWM-SW
C. Casazza, 2ORC-WTS

ATTACHMENT I

Please submit the following in accordance with the procedures set forth in Attachment II:

1. A detailed report explaining past and present laboratory sink waste disposal activities relative to the retention basin. This report shall also include a summary outlining what constituents were discharged into the basin and for what period of time these constituents were discharged into the basin.

2. A detailed operating history of the retention basin. This shall include the day-to-day amounts of lab sink wastes placed in the basin.

3. An engineering drawing of the retention basin. In addition, a written summary of the design and operating parameters shall accompany this drawing.

4. A detailed map showing the facility and the area 1,000 feet around the property line. The scale of the map shall be such that one inch may not equal more than 200 feet. In addition to showing the location of the retention basin, the map must indicate each existing and former solid waste management unit.

5. A plot plan showing the retention basin area and proposed soil boring locations for soil sampling, if required in the future.

6. A hydrogeologic report for the facility area if available.

7. A plot plan showing locations and depths of any existing wells in the facility area.

8. All internal memoranda and outside correspondence regarding the retention basin.

9. Report of soil and sediment sample analyses done at the facility to date.

ATTACHMENT II

Instructions

In responding to this Request for Information, the following instructions shall apply:

1. A response should be made individually to each question.

2. Precede each answer with the number of the question to which it is addressed.

3. In answering each question identify all contributing sources of information.

4. "And" as well as "or" shall be construed either disjunctively of conjuntively as necessary to bring within the scope of these questions any information which might otherwise be construed to be outside their scope.

5. If you are unable to answer a question in a detailed and complete manner or if you are unable to provide any of the information or documents requested, indicate the reason for your inability to do so. If you have reason to believe there may be an individual who may be able to provide a more detailed or complete response to any question or who may be able to provide documents requested, state that person's name, address and phone number.

6. Where a list of pertinent records and documents is requested, you may submit a copy of the actual document or documents in lieu of the requested list.

7. For each document produced in response to this Request for Information, indicate on the document, or in some other reasonable manner, the number of the question to which it responds.

8. If anything is deleted from a document produced in response to this Request for Information, state:

   a. the reason for the deletion, and

   b. the subject matter of the deletion.

9. Where documents are requested but are not available, state the reason for their unavailability. However, to the best of your ability identify any such document by stating its author, date, subject matter, number of pages, and any recipients.

10. If you cannot provide a precise answer to a question, you may approximate, but in any such instance state the reason why you cannot be more specific.

REFERENCE NO. 2

Diamond Shamrock
Chemicals Company

ENVIRONMENTAL PROTECTION
AGENCY, REGION II
NEW YORK, N.Y.

1986 JUL -1 AM 11:50 Technical Center

PERMITS ADMINISTRATION
BRANCH

June 27, 1986

Mr. R. A. Baker, Chief
Permits Administration Branch
U.S. ENVIRONMENTAL PROTECTION AGENCY
Region II
26 Federal Plaza - Room 432
New York, New York 10278

Dear Mr. Baker:

Response to RCRA Information Request (5/28/86)
Morristown, N.J. Facility Inspection (2/14/86)
Diamond Shamrock Chemicals Company
EPA I.D. No. NJDO52449022

As required in the above-referenced information request, we submit the attached response. In brief, we do not dispose of hazardous waste using the lab sink washwater collection system. Also, the aeration system in the lab sink washwater sump was likely never operated, and certainly not within the past ten years.

If you have any questions, please telephone me directly at 216-357-3671.

Sincerely,

Paul J. Dugas
Sr. Environmental Engineer

cor

RESPONSE FOR ATTACHMENT I TO U.S. EPA - 5/28/86 LETTER

1. To our knowledge, hazardous waste was not and is not discharged to the lab sink washwater collection system. Lab chemical wastes are collected separately in each lab and eventually disposed using RCRA approved procedures. Only glassware washwater is disposed through the lab sinks. This procedure has been used throughout the life of the lab facilities, since 1971, and continues in effect today.

   The lab sink washwater sump was installed as part of the original Process Chemicals Division's Headquarters/Lab building sewer system which was completed in 1971. As a safeguard, the lab sink sewer system was separated from the rest of the building sanitary sewer system. As an additional safeguard, a collection sump was installed at the end of the lab sink sewer system. A basic aeration unit was originally installed in this sump to allow some degree of pretreatment should it ever be needed. Although our records are incomplete, we don't believe the aeration unit was ever operated, and certainly not during the last ten years.

2. See Item No. 1 for lab sink washwater sump operating data and history. Our records do not show how much of the total facility wastewater discharge comes from the sanitary wastewater system and how much from the lab sink washwater system. Based on a sketch dated 12/30/74 (attached), a flowrate of about 2 gallons per minute was estimated early in the lab sink washwater system's life. The facility operation is about 10 hours/day, 5 days/week, 52 weeks/year, for water discharge estimation purposes. The total facility discharge, including lab sink washwater and sanitary wastewater combined has been measured at 7,690 gallons per day.

3. Two drawings are attached. One sketch, dated 12/30/74, shows the general plan and cross-section. Drawing 1335-11-D-B-1M shows the lab sink wastewater sump in relation to the sanitary sewer system and rainfall runoff system.

4. See attached maps/drawings.

5. See attached maps for location of the lab sink washwater sump. No soil borings are needed.

6. No hydrogeologic report for the area is available.

7. There are no wells on our property. None are known in our vicinity.

8. Correspondence concerning the lab sink washwater sump is attached.

9. Included in the correspondence attached in Item No. 8 is an analysis of the wastewater accumulated in the lab sink washwater sump. This sample contained a large amount of algae, decomposing leaves, etc.

Diamond Shamrock

Interoffice Correspondence

To: Frank Gunzel - Morristown
From: Hadley Bedbury - Environmental and Safety Services (Pasadena)
Date: August 28, 1984

D 11(

Subject: Old Lab Retention Tank

On August 24, I spoke with Allen Herbert of the Township of Morris about future requirements for our wastewater discharge. He advised us that their Pretreatment Standards have not been finalized. His quick review of the data which we had previously submitted, indicted that we are close to the proposal limits for BOD and some trace metals such as copper. He indicated that these requirements should be finalized by March 1, 1985.

It is not certain whether we could require treatment on the entire discharge or on the non-sanitary stream flowing through this tank. We should defer closure on this tank until we have been advised of any new treatment or monitoring requirements.

I will keep you advised on this subject.

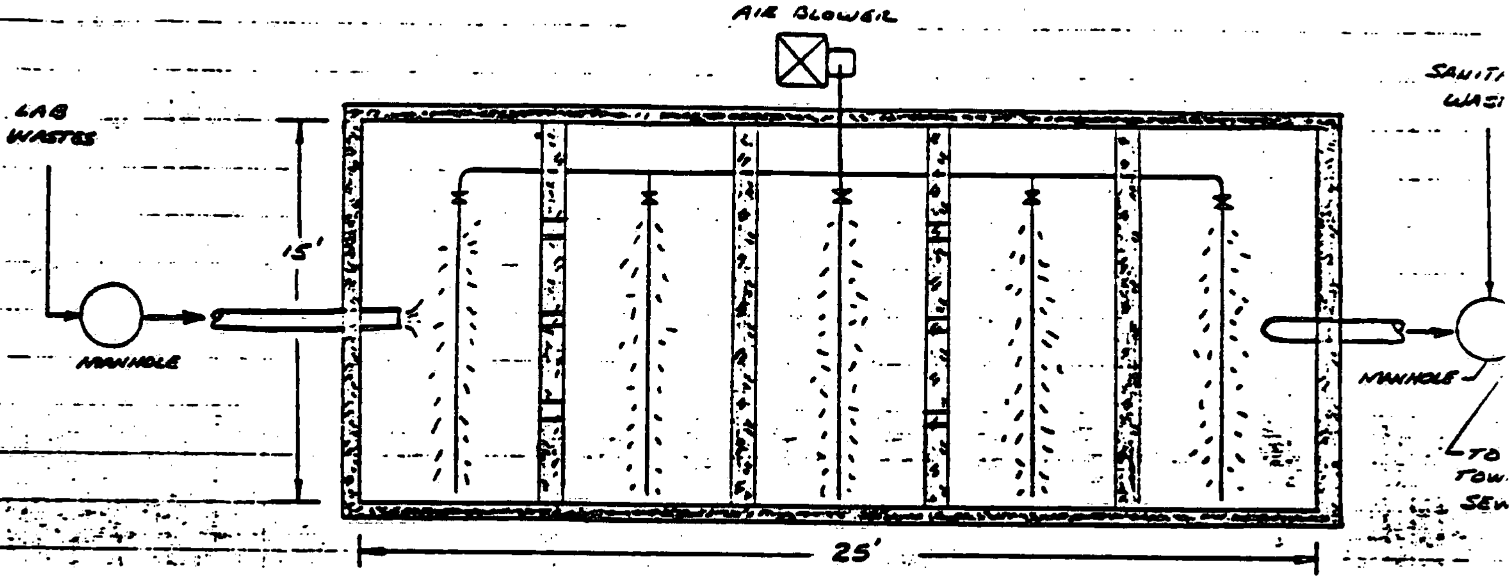
Hadley

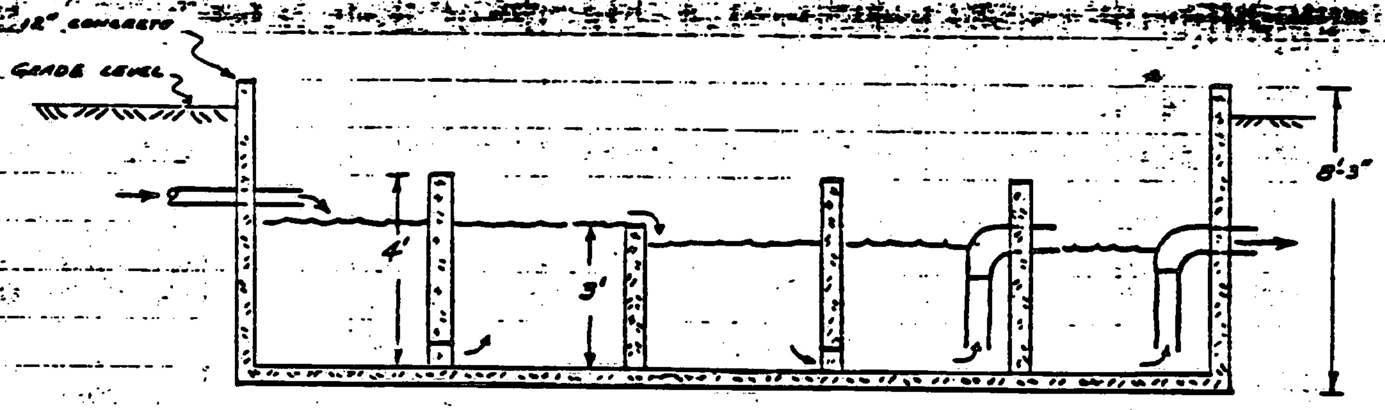
Hadley Bedbury

HB/sd

12/30/
S.G

LAB WASTE AERATED RETENTION BASIN





BASIN LIQ. VOL.

15 x 4.5 x 3 x 2 = 405 ft³

15 x 4.5 x 2.5 x 3 = 506 ft³

total = 911 ft³

RETENTION TIME

FLOW ~ 2GPM x 60 x 8 hr/day = 960 GPD

R.T. = $\frac{911}{960}$ ≈ 1 day

Diamond Shamrock

Interoffice Correspondence

To: Larry Smith - Pasadena
From: Hadley Bedbury - Environmental and Safety Services (Pasadena)
Date: November 14, 1985

Subject: Morristown Wastewater D 118 D

Enclosed is a completed waste characterization for Morristown's wastewater sump. This material is considered non-hazardous by New Jersey and EPA. New Jersey does not allow any liquids into its landfills. I would consider wastewater treatment operations such as SCA - Newark, DuPont, Chem-Clear or Enviro-rite.

Hadley

Hadley Bedbury

HMB/mp

Diamond Shamrock
Chemicals Company
A Subsidiary of Diamond Shamrock

WASTE CHARACTERIZATION AND SUMMARY SHEET

4613-A (Rev. 10/85)

Diamond Shamrock Waste Code Number: (10-Digit)

General Instructions: In order to lawfully and safely handle each waste, it is important that this profile sheet be properly completed. Parts A and B are to be completed and signed in providing the waste description. Please show an answer or response to each section, as this will eliminate the need for completing the form later on. Responses should be in ink or typewritten. BE CERTAIN TO DATE AND SIGN THE APPROPRIATE CERTIFICATIONS. An unsigned form cannot be processed. Make a copy of this form for your records returning the original to the appropriate Environmental Services Group.

PART A – GENERAL

Client Name: Diamond Shamrock Chemicals Company	Generating Facility Name: Morristown, New Jersey
Client Address: 350 Mt. Kemble Avenue	Facility EPA I.D. Number: NJD052449022
Morristown, New Jersey 07960-1931	State I.D. Number: Same

Client Contacts:		Title	Phone Number
Operations	J. Bayone		(201) 540-9
Technical	Hadley Bedbury	Sr. Environmental Engineer	(713) 476-1

Process Generating Waste:
Stagnant water from concrete holding area - rainfall, fungus, algae accumulation

Name of Waste
N/A

Have you obtained any laboratory analytical report analysis of this waste at any time? [X] Yes [ ] No — If 'Yes', attach the most recent analytical report and show the date(s) of the report(s):

Is this waste a 'Hazardous Waste' as defined by USEPA (40 CFR Part 261)? [ ] Yes [X] No — If Yes, the EPA Waste I.D. Number(s) are:

Check if additional waste codes are included in Part B, Section 5 — If 'Yes' do you qualify as a small quantity generator (40 CFR 261.5)? [ ] Yes [ ] N

Is this waste regulated by your State Regulatory Agency? [ ] Yes [X] No — If 'Yes' the state waste I.D. No's. and/or Classifications are: I.D. #72

General Waste Characteristics and Quantities

Waste is: [ ] Organic [ ] Inorganic [X] Both Organic & Inorganic

Phases/Layers: [ ] Single [ ] Bilayered [X] Multilayer

Physical State at 70°F: [ ] Solid [X] Semisolid/Sludge [ ] Liquid [ ] Dust/Powder

Free Liquids: [X] Yes [ ] No [ ] Possible

Characteristic Color: Black

Distinctive Odor: Slight Organic [ ] None

Amount Generated: Gallons | Tons | Cubic Yards 40 | Drums

Per: [ ] Day [ ] Week [ ] Month [ ] Year [X] One Ti

Shipping Information (needed for manifests, container marking/Labeling, vehicle placarding)

Waste will be shipped in: N/A

DOT Proper shipping name (49 CFR 172.101(2)): N/A

DOT UN/NA Number (49 CFR 172.101 (3A)): N/A

DOT Hazard class and Hazard Class Identification number (40 CFR 262 Appendix Table 1)
N/A

Will packages contain a reportable quantity of a Hazardous substance? (49 CFR 172.101(2) and 171.8) [ ] Yes [X] No

Stagnant water from concrete holding area - rainfall, fungus, algae accumulation, Page 2

ART B – WASTE CHARACTERISTICS AND COMPOSITS

GENERAL INSTRUCTIONS FOR COMPLETING THIS PART: Provide all the detail concerning this waste. Answer every question with the best information you have. If you have no analytical data concerning a particular area of inquiry, use your knowledge of the process and raw materials in formulating your answer. If you have any analytical data, use all of it in providing answers. Multiple analyses of the waste can provide a good basis for determining the range of a component or characteristic present in one or more samples.

It is important to show the probable range of waste components or characteristics. Please answer with ranges, if you can. Important Note: Unless you state otherwise, all analytical data which you summarize here, should be based on "Representative Samples" of the waste as that term is commonly understood, and USEPA analytical methods or procedures where applicable.

Physical/Chemical Characteristics (Provide data or check appropriate boxes if no data)

Flash Point (Using closed cup test at 40 CFR 261.21(2) (1)) <205 °F — [ ] Not tested, but would be greater than 140° F — [ ] Not tested

Is the waste an oxidizer (per 40 CFR 172.151)? [ ] Yes [X] No [ ] Not tested

pH: (Using method at 40 CFR 261.22 (2) (1)) 6.28 — [ ] pH not tested, as waste not aqueous — [ ] Not tested

Is the waste a corrosive (using steel corrosion test at 40 CFR 261.22 (a) (2))? [ ] Yes [X] No [ ] Not tested

Is the waste a reactive (per 40 CFR 261.23)? [ ] Yes [X] No [ ] Not tested

If Yes explain:

Solid Content: % Wt. Total ≈1% [X] Not tested	% Free Liquids ≈99 [X] Not tested	Specific Weight: ≈64 lbs. per cu.ft.	[ ] Not determinable because of nature of waste [ ] Not tested
BTU's per pound [X] Not tested	Ash Content % Wt. [X] Not tested	Alpha Radiation as pCi/1:	[ ] Waste has not been irradiated & contains no known radioactive elements [ ] Not tested
Viscosity N/A cps	Melting Point N/A °F	Boiling Point 205 °F	

Chemical Composition

MAJOR Components - Compound	Concentration % Range	Chemical Formula
Water	≈99%	H_2O
Dirt, Vegetation, Residue	0-1%	
Algae, Fungus	0-1%	

Does waste contain organically bound halogens?	[ ] Yes	[ ] No	[X] Not tested	Show wgt. % if data available
Does waste contain organically bound Sulfur?	[ ] Yes	[ ] No	[X] Not tested	Show wgt. % if data available
Does waste contain cyanide compounds?	[X] Yes	[ ] No	[ ] Not tested	Show wgt. % if data available 0.067 mg/kg wet solid
Does waste contain sulfides, sulfites or bisulfites?	[X] Yes	[ ] No	[ ] Not Tested	Show wgt. % if data available 4.10 mg/kg wet solid
Does waste contain PCBs?	[ ] Yes	[X] No	[X] Not tested	Show wgt ppm or %
Does waste contain Phenols?	[X] Yes	[ ] No	[ ] Not tested	Show wgt % if data available 3.14 ppm

Is waste a pesticide or produced in pesticide manufacturing or processing? [ ] Yes [X] No

If Yes, state whether it contains:

[ ] Organophosphates [ ] Organophosphates With and Sulfur [ ] Chlorinated Hydrocarbons [ ] Carbamates [ ] Other Active Ingredients

EXTRACTABLE (Leachable) Waste Components

Provide a Yes or No answer to the questions in Column B for each of the elements or compounds listed in Column A. If you have concentration data on other parameters, list these parameters in the blank spaces at the bottom of Column A. Provide the information called for in Columns C and D if you have the analytical data. Leachable concentrations shown in Column D should be based upon representative waste samples, using The Extraction Procedure and Analytical Procedures specified in Appendices I, II, and III of 40 CFR Part 261, unless you state otherwise. Please use Section 8 to describe other procedures used.

A	B		C		D	
Element/Compound	Tested*		Total Concentration in waste ~~%~~ X ppm		Leachable Conc. (ppm) (Acutal analysis) (ppm)	
	Yes	No **	Low	High	XXX	XXXX
Ag – Silver	X				<0.035	
As - Arsenic	X				<.005	
Ba – Barium	X				<.602	
Cd – Cadmium	X				<.006	
Cr – Chromium - trivalent					<.015	
Cr – Chromium - hexavalent						
Cu – Copper						
Hg – Mercury	X				<.025	
Ni – Nickel						
Pb – Lead	X				<.267	
Sb – Antimony						
Se – Selenium	X				<.005	
Zn – Zinc						
Endrin						
Lindane						
Methoxychlor						
Toxaphene						
2,4–D						
2,4,5–TP Silvex						
Others						
TOC	X				3500	
Total Petroleum						
Hydrocarbons	X					

* *Experience and/or knowledge of the process may be a basis in lieu of testing to determine that there is no reasonable likelihood of the substance's pre[sence] in the waste.*

** *The substance is not used as a raw material, and is not produced as a by-product or intermediate in the process and therefore was not tested as there [is no] reason to expect its presence.*

Miscellaneous Additional Information or Explanations (i.e., any special handling, precautions)

..agnant water from concrete holding area - rainfall, fungus, algae ...

...TIFICATION OF INFORMATION IN PARTS A AND B

I certify I am an employee of Diamond Shamrock and have been authorized to sign this certification. I have read and followed the instructions provided and have reviewed the answers and data entered above. The information and answers in Parts A and B were entered in accordance with the instructions given, and are complete, true and correct to the best of my knowledge, information and belief. Analytical data known by me in my possession has been entered. I understand this information will be utilized by others in determining safe and lawful methods of handling, transporting, storing, treating and/or disposing of this waste.

Name ______________________ Signature ______________________

Title: ______________________ Date: ______________________

Recertified: (required annually)*

______________________ ______________________

______________________ ______________________

Reviewed by Environmental Services:

Hadley Bedbury
Signature

Date 11/14/85

Recertified: (required annually)*

______________________ ______________________

______________________ ______________________

Reviewed by Environmental Services:

______________________ Date: ______________________
Signature

** or more often if a raw material is changed or the process is changed in such a way to affect Chemical Composition ranges or components.*

CONFIDENTIALITY

The contractor understands that the information conatined herein must not be disclosed to third parties, except as required by law or regulation, without prior written consent of Diamond Shamrock since disclosure could lead to discovery of certain product compositions, injuring Diamond Shamrock's competitive advantage over certain competing producers. This information is to be used solely in carrying out the waste disposal activities associated herewith.

Contractor: ______________________ ______________________
Name Signature

By ______________________ ______________________
Name Date

____
Title

INDUSTRIAL
CORROSION
MANAGEMENT
INCORPORATED

1152 ROUTE 10 RANDOLPH, NEW JERSEY 07869 201-584-0330

NJDEP Certified Drinking Water/
Wastewater Laboratory ID 14116

REPORT DATE: July 12, 1985

LAB # 42993-G of AG

CLIENT: DIAMOND SHAMROCK CORP.

SAMPLE SOURCE: SEDIMENT SAMPLE COLLECTION BASIN

SAMPLE DATE: 6/20/85 SAMPLED BY: ICM-RK AT LAB DATE: 6/20/85

LABORATORY ANALYSIS
REPORT

Parameter	Result
TOC	3500
Total Phenol	3.14

All results reported in mg/l (ppm).

We thank you for this opportunity to serve you. If you have any questions, please do not hesitate to call.

INDUSTRIAL CORROSION MANAGEMENT, INC.

Edwin Tichenor
Vice President

ET/jmg
encl.
LT=Less Than

INDUSTRIAL
CORROSION
MANAGEMENT
INCORPORATED
12 ROUTE 10 RANDOLPH, NEW JERSEY 07869 201-584-0330

State Certified Drinking Water/Wastewater Laboratory ID # 14116

REPORT DATE: July 12, 1985

LAB # 42993 A of AG

SAMPLE SOURCE: DIAMOND SHAMROCK CORP. SAMPLE ID: SEDIMENT SAMPLE COLLECTION BASIN

SAMPLE DATE: 6/20/85 TAKEN BY: ICM-RK AT LAB DATE: 6/20/85

EP TOXICITY TEST
Leachate Analysis (CFR Vol. 45, No. 98)

PARAMETERS TESTED Inorganic Chemicals by AA	TEST RESULT as mg/l	MAXIMUM PERMISSIBLE Concentration as mg
Arsenic	LT 0.005	5.0
Barium	0.602	100.0
Cadmium	LT 0.006	1.0
Chromium	LT 0.015	5.0
Lead	LT 0.267	5.0
Mercury	LT 0.025	0.2
Selenium	LT 0.005	1.0
Silver	LT 0.035	5.0

ANALYSIS PERFORMED ON SOLID SAMPLE

Total Cyanide	0.067
Sulfide (as S)	4.10

pH (units) 6.28

Flash Point GT 96°C Boiled @ 90°C
(Pensky-Marten Closed Cup Method)

LT=Less than GT=Greater Than

Solid sample results reported in mg/kg wet weight basis.

INDUSTRIAL CORROSION MANAGEMENT, INC.

Edwin Tichenor, Vice President

Diamond Shamrock
Chemicals Company

Interoffice Correspondence

To: Hadley Bedbury at Pasadena
From: Jim Bayone at Morristown
Date: December 6, 1985

D 118

Subject: Pit analysis

The Petroleum Hydrocarbon Analysis you requested is attached.

Three companies have called in response to a letter from Larry Smith for a quote to remove contents of this pit.

On the basis of this analysis and previous analyis, do you consider contents hazardous or non-hazardous? If non-hazardous, can pit simply be closed with clean fill (i.e. dirt) instead of being pumped out?

JB:bt

cc F. Guenzel

ICM INDUSTRIAL CORROSION MANAGEMENT INCORPORATED
1152 ROUTE 10, RANDOLPH, NEW JERSEY 07869 201-584-0330

NJDEP Certified Drinking Water/
Wastewater Laboratory ID #14116

REPORT DATE: November 27, 1985

LAB # 49167

CLIENT: DIAMOND SHAMROCK

SAMPLE SOURCE: Pit

SAMPLE DATE: 11/19/85 SAMPLED BY: ICM-R. Kellner AT LAB DATE: 11/19/85

Parameter	Result	
**Petroleum Hydrocarbon -----------------	120,000	mg/kg dwb
Moisture (percentage) -----------------	89.5	%

Results are reported in mg/kg dry weight basis, unless otherwise stated.

We thank you for this opportunity to serve you. If you have any questions, please do not hesitate to call.

Very truly yours,
INDUSTRIAL CORROSION MANAGEMENT, INC.

Richard S. Levine
Richard S. Levine
President

RSL:
LT=Less Than
dwb=Dry Weight Basis

**This test employs analytical methodology which can give false positive readings. Simply stated, this test is measuring the Carbon-Hydrogen linkage in organic molecules. While Petroleum Hydrocarbons most certainly possess this link, a number of organic molecules (Humus, Lignin etc.) not considered petroleum based, also possess it as well. Therefore, in order to more correctly confirm a high reading, it is suggested that a GC run be additionally performed.

_______The above Total Petroleum Hydrocarbon concentration may not represent true Petroleur Hydrocarbon value as indicated by an interferance at 1745 cm^{-1}.

REFERENCE NO. 3

CERTIFIED MAIL #P 646 687 270
Return Receipt Requested

Diamond Shamrock
Chemicals Company

Process Chemicals Division

August 15, 1986

Mr. R.A. Baker
Chief
Permits Administration Branch
U.S. EPA - Region II
26 Federal Plaza - Room 432
New York, New York 10278

REFERENCE: Additional response to RCRA information request (5/28/86)
Morristown, New Jersey Facility Inspection (2/14/86)
Diamond Shamrock Chemicals Company
EPA ID No. NJD052449002

Dear Mr. Baker:

Mr. Ezekwo, U.S. EPA, Region II, correctly pointed out in our telephone coversation August 13th that the two documents provided during the inspection indicate that the lab sink waste water aeration system was probably used from 1971 to early 1975. Based on this, I must revise the previous statement in my June 27, 1986 letter that we didn't believe this system was ever operated. These documents support the second part of my statement however, that the aeration system was certainly not used during the last ten years. These documents indicate that the system was shut down some time in early 1975. These documents are:

1) DSCC 1/3/75 interoffice memo from S.C. Gordon to C.W. Lighthipe
2) DSCC 1/21/75 letter from S.C. Gordon to R. Banghart, Superintendent, Morris Township Sewage Treatment Plants

I apologize for not having this information earlier. I had checked with current engineering and building service personnel, neither of whom was in that area of responsibility in the early 1970's. Their combined experience in Morristown covered only the last ten years. I also had our environmental files reviewed (S.C. Gordon was a member of that group but is no longer with Diamond Shamrock) and neither these documents nor any other relevant records from that time were found. A long-term employee, not presently in building services, managed to located these two documents in some of his old files.

Again, I apologize for any inconvenience my not having this information to provide may have caused. I trust this explanation will resolve the matter to your satisfaction. If you have any questions, please call me at (201) 267-1000, extension 553.

Sincerely,

P.J. Dugas

P.J. Dugas
Sr. Environmental Engineer

REFERENCE NO. 4

NUS CORPORATION AND SUBSIDIARIES — **TELECON NOTE**

CONTROL NO:	DATE:	TIME:
02 - 8902 - 16	3/16/89	3:00 pm

DISTRIBUTION: Oxy Process Chemicals, Inc

BETWEEN:	OF:	PHONE:
Edward Clancy	Lab Supervisor Henkel Process Chemicals	(201) 267-1000

AND: Gary Rotch

DISCUSSION:

Status of facility:

- Laboratory is presently active
- Sampling was conducted by IT Corp. in spring of 1988. Results showed that lab waste retention pit contents were non-hazardous. The pit or basin was pumped out last year. Sampling of drum storage areas also revealed no contamination
- Facility is scheduled to be shut down at end of April. At that time all wastes will be removed.
- Lab retention tank contained lab washwater which was also not hazardous
- Sampling in 1988 was part of ECRA process during transfer of ownership from Oxy Process Chemicals

ACTION ITEMS:

to Henkel Processes.

Gary Rotch 3/16/89

REFERENCE NO. 5

Please print or type in the unshaded areas only (fill—in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-R0175

EPA GENERAL INFORMATION

Consolidated Permits Program
(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER: F NJD052449022

LABEL ITEMS

I. EPA I.D. NUMBER
III. FACILITY NAME
V. FACILITY MAILING ADDRESS
VI. FACILITY LOCATION

NJD052449022

DIAMOND SHAMROCK CORP
350 MT ~~KEMBLE AVE~~
MORRISTOWN, ~~NJ 07960~~

350 MT ~~KEMBLE AVE~~
MORRISTOWN, NJ 07960

GENERAL INSTRUCTIONS
If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill—in area below. Also, if any of the preprinted data is absent (the area to the left of the label space lists the information that should appear), please provide it in the proper fill—in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI (except VI-B which must be completed regardless). Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold—faced terms.

SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED
A. Is this facility a publicly owned treatment works which results in a discharge to waters of the U.S.? (FORM 2A)		X		B. Does or will this facility (either existing or proposed) include a concentrated animal feeding operation or aquatic animal production facility which results in a discharge to waters of the U.S.? (FORM 2B)		X	
C. Is this a facility which currently results in discharges to waters of the U.S. other than those described in A or B above? (FORM 2C)		X		D. Is this a proposed facility (other than those described in A or B above) which will result in a discharge to waters of the U.S.? (FORM 2D)		X	
E. Does or will this facility treat, store, or dispose of hazardous wastes? (FORM 3)	X		X	F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
I. Is this facility a proposed stationary source which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X		J. Is this facility a proposed stationary source which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X	

III. NAME OF FACILITY

1 SKIP DIAMOND SHAMROCK CORPORATION

IV. FACILITY CONTACT

A. NAME & TITLE (last, first, & title)	B. PHONE (area code & no.)
2 SCHILLON SANDRA ANALYST	201 267 1000

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX
3 POBOX 2386-R

B. CITY OR TOWN	C. STATE	D. ZIP CODE
4 MORRISTOWN	NJ	07960

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER
5 350 MT KEMBLE AVENUE

B. COUNTY NAME
MORRIS

C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE (if known)
6 MORRISTOWN	NJ	07960	

EPA Form 3510-1 (6-80)

CONTINUE ON REVERSE

CONTINUED FROM THE FRONT

(specify in order of priority)

A. FIRST		B. SECOND	
7 2843	(specify) SURFACE ACTIVE AGENTS	7 2899	(specify) CHEMICALS AND CHEMICAL PREPARATIONS, NOT ELSEWHERE CLASSIFIED
C. THIRD		**D. FOURTH**	
7 2869	(specify) INDUSTRIAL ORGANIC CHEMICALS, NOT ELSEWHERE CLASSIFIED.	7 2821	(specify) PLASTIC MATERIALS AND RESINS

III. OPERATOR INFORMATION

A. NAME

8 DIAMOND SHAMROCK CORPORATION

B. Is the name listed in Item VIII-A also the owner? ☒ YES ☐ NO LEASED

C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box; if "Other", specify.)

F = FEDERAL
S = STATE
P = PRIVATE
M = PUBLIC (other than federal or state)
O = OTHER (specify)

P (specify)

D. PHONE (area code & no.)

A 214 745 2000

E. STREET OR P.O. BOX

717 NORTH HARWOOD STREET

F. CITY OR TOWN	G. STATE	H. ZIP CODE
B DALLAS	TX	75201

IX. INDIAN LAND

Is the facility located on Indian lands?

☐ YES ☒ NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water)	D. PSD (Air Emissions from Proposed Sources)	
N	9 P	
B. UIC (Underground Injection of Fluids)	**E. OTHER (specify)**	
U	9 25337	(specify) N.J. D.E.P. PLANT I.D. NUMBER
C. RCRA (Hazardous Wastes)	**E. OTHER (specify)**	
R	9	(specify)

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property bounderies. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements. 4 QUADRANGLE MAPS ATTACHED. F9:A/50

XII. NATURE OF BUSINESS (provide a brief description)

At Diamond Shamrock's Process Chemicals Division headquarters in Morris Township, some 260 people are employed in a variety of research and administrative tasks. These operations include marketing, sales, technical service, customer service, research and development, commercial development, laboratory product testing, purchasing, data processing and accounting functions.

The Division's products are designed to solve customer manufacturing and process problems and to upgrade customer products. Among these products inventoried in sample sizes at Morristown are: dispersants, surfactants, defoamers, lubricants, antistatic agents, emulsifiers, thickeners, biocides, epoxy hardeners, latex stabilizers, coating additives, tackifiers, leveling agents, dye fixatives, after-clearing agents, spin finishes, antimigrants, print auxiliaries, flocculants, wet strength resins, wax sizes and many more.

F9: A/51

These products are sold into a variety of markets including paper, textiles, paint, coatings, concrete, oil drilling, agriculture, cosmetics, plastics, rubber, adhesives and tanning.

XIII. CERTIFICATION (see instructions)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print)	B. SIGNATURE	C. DATE SIGNED
KENNETH P. MITCHELL GENERAL MANAGER	KP Mitchell	11/13/80

COMMENTS FOR OFFICIAL USE ONLY

Please print or type in the unshaded areas only
(fill-in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-S80004

FORM 3 RCRA

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

HAZARDOUS WASTE PERMIT APPLICATION

Consolidated Permits Program

(This information is required under Section 3005 of RCRA.)

I. EPA I.D. NUMBER

F N J D 0 5 2 4 4 9 0 2 2 5 1

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (yr., mo., & day)	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below *(mark one box only)* to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

A. FIRST APPLICATION *(place an "X" below and provide the appropriate date)*

[X] 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)*

[ ] 2. NEW FACILITY *(Complete item below.)*

C: 8 — YR. 70 MO. 11 DAY 24

FOR EXISTING FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* ~~OPERATION BEGAN~~ OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*

YR. __ MO. __ DAY __ FOR NEW FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR IS EXPECTED TO BEGIN

B. REVISED APPLICATION *(place an "X" below and complete Item I above)*

[ ] 1. FACILITY HAS INTERIM STATUS

[ ] 2. FACILITY HAS A RCRA PERMIT

III. PROCESSES – CODES AND DESIGN CAPACITIES

A. PROCESS CODE – Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process *(including its design capacity)* in the space provided on the form *(Item III-C)*.

B. PROCESS DESIGN CAPACITY – For each code entered in column A enter the capacity of the process.
1. AMOUNT – Enter the amount.
2. UNIT OF MEASURE – For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
~~CONTAINER *(barrel, drum, etc.)*~~	~~S01~~	~~GALLONS OR LITERS~~
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER *(Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)*	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE
~~GALLONS~~	~~G~~
LITERS	L
CUBIC YARDS	Y
CUBIC METERS	C
GALLONS PER DAY	U
LITERS PER DAY	V
TONS PER HOUR	D
METRIC TONS PER HOUR	W
GALLONS PER HOUR	E
LITERS PER HOUR	H
ACRE-FEET	A
HECTARE-METER	F
ACRES	B
HECTARES	Q

EXAMPLE FOR COMPLETING ITEM III *(shown in line numbers X-1 and X-2 below)*: A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

C DUP — T/A — C 1

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S 0 2	600	G	
X-2	T 0 3	20	E	
1	S 0 1	5,500 000	G	
2				
3				
4				
5				
6				
7				
8				
9				
10				

Continued from the front.

III. PROCESSES *(continued)*

C. SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESSES *(code "T04")*. FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPACITY.

IV. DESCRIPTION OF HAZARDOUS WASTES

A. **EPA HAZARDOUS WASTE NUMBER** — Enter the four–digit number from 40 CFR, Subpart D for each listed hazardous waste you will handle. If you handle hazardous wastes which are not listed in 40 CFR, Subpart D, enter the four–digit number*(s)* from 40 CFR, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.

B. **ESTIMATED ANNUAL QUANTITY** — For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non–listed waste*(s)* that will be handled which possess that characteristic or contaminant.

C. **UNIT OF MEASURE** — For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. **PROCESSES**

1. PROCESS CODES:
   For listed hazardous waste: For each listed hazardous waste entered in column A select the code*(s)* from the list of process codes contained in Item III to indicate how the waste will be stored, treated, and/or disposed of at the facility.
   For non–listed hazardous wastes: For each characteristic or toxic contaminant entered in column A, select the code*(s)* from the list of process codes contained in Item III to indicate all the processes that will be used to store, treat, and/or dispose of all the non–listed hazardous wastes that possess that characteristic or toxic contaminant.
   Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code*(s)*.
2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER — Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

1. Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B,C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other EPA Hazardous Waste Number that can be used to describe the hazardous waste.

EXAMPLE FOR COMPLETING ITEM IV *(shown in line numbers X-1, X-2, X-3, and X-4 below)* — A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non–listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. EPA HAZARD. WASTE NO. *(enter code)*	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE *(enter code)*	D. PROCESSES 1. PROCESS CODES *(enter)*				D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
X-1	K 0 5 4	900	P	T 0 3	D 8 0			
X-2	D 0 0 2	400	P	T 0 3	D 8 0			
X-3	D 0 0 1	100	P	T 0 3	D 8 0			
X-4	D 0 0 2							*included with above*

CONTINUE ON PAGE 3

Continued from page 2.
NOTE: Photocopy this page before completin… …ave more than 26 wastes to list.

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1): W N J D 0 5 2 4 4 9 0 2 2 | T/A: 3 | C: 1

FOR OFFICIAL USE ONLY: W DUP | T/A: 3 | C: 2 | DUP

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)	D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	U002	2,000000	P	S01	
2	U007	45000	P	S01	
3	U008	45000	P	S01	
4	U031	20000	P	S01	
5	U052	50000	P	S01	
6	U140	50000	P	S01	
7	U154	50000	P	S01	
8	U159	250000	P	S01	
9	U161	25000	P	S01	
10	U165	250000	P	S01	
11	U188	100000	P	S01	
12	U220	250000	P	S01	
13	U239	200000	P	S01	
14	D001	10,400000	P	S01	
15	D000				INCLUDED WITH ABOVE
16	D007				INCLUDED WITH ABOVE
17	D000	4,000000	P	S01	
18	D002	5,400000	P	S01	
19	D000				INCLUDED WITH ABOVE
20	D003	450000	P	S01	
21					
22					
23					
24					
25					
26					

CONTINUE ON REVERSE

Continued from the front.

. DESCRIPTION OF HAZARDOUS WASTES (continued)

. USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3.

THIS IS A RESEARCH FACILITY WHERE CHEMICALS OF ALL TYPES ARE USED IN SYNTHESIS. WE ARE AWARE OF THE PRESENCE OF SMALL QUANTITIES OF THE FOLLOWING CHEMICALS [LISTED IN 40 CFR 261.33(e) & (f)] ON OUR LAB SHELVES. THEY COULD REASONABLY BE EXPECTED TO BE OFFERED PER SE FOR DISPOSAL AS HAZARDOUS WASTE AT SOME FUTURE POINT IN TIME.

P053	U044	U123	U219
P100	U054	U147	U223
P106	U080	U169	U226
U039	U122	U196	U228

F6: A/55 F6: A/56

EPA I.D. NO. (enter from page 1)

N J D 0 5 2 4 4 9 0 2 2 T/A C 3 6

. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail).* ATTACHED

. PHOTOGRAPHS

All existing facilities must include photographs *(aerial or ground—level)* that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail).* ATTACHED

VII. FACILITY GEOGRAPHIC LOCATION

LATITUDE *(degrees, minutes, & seconds)*	LONGITUDE *(degrees, minutes, & seconds)*
40 45 130	074 30 000

VIII. FACILITY OWNER

[X] A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items: RESEARCH BUILDING FACILITY LEASED TO AND OPERATED BY:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. *(area code & no.)*
DIAMOND SHAMROCK CORPORATION	214-745-2000

3. STREET OR P.O. BOX	C	4. CITY OR TOWN	5. ST.	6. ZIP CODE
717 NORTH HARWOOD STREET	G	DALLAS	TX	75201

. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED
KENNETH P. MITCHELL GENERAL MANAGER	K.P. Mitchell	11/13/80

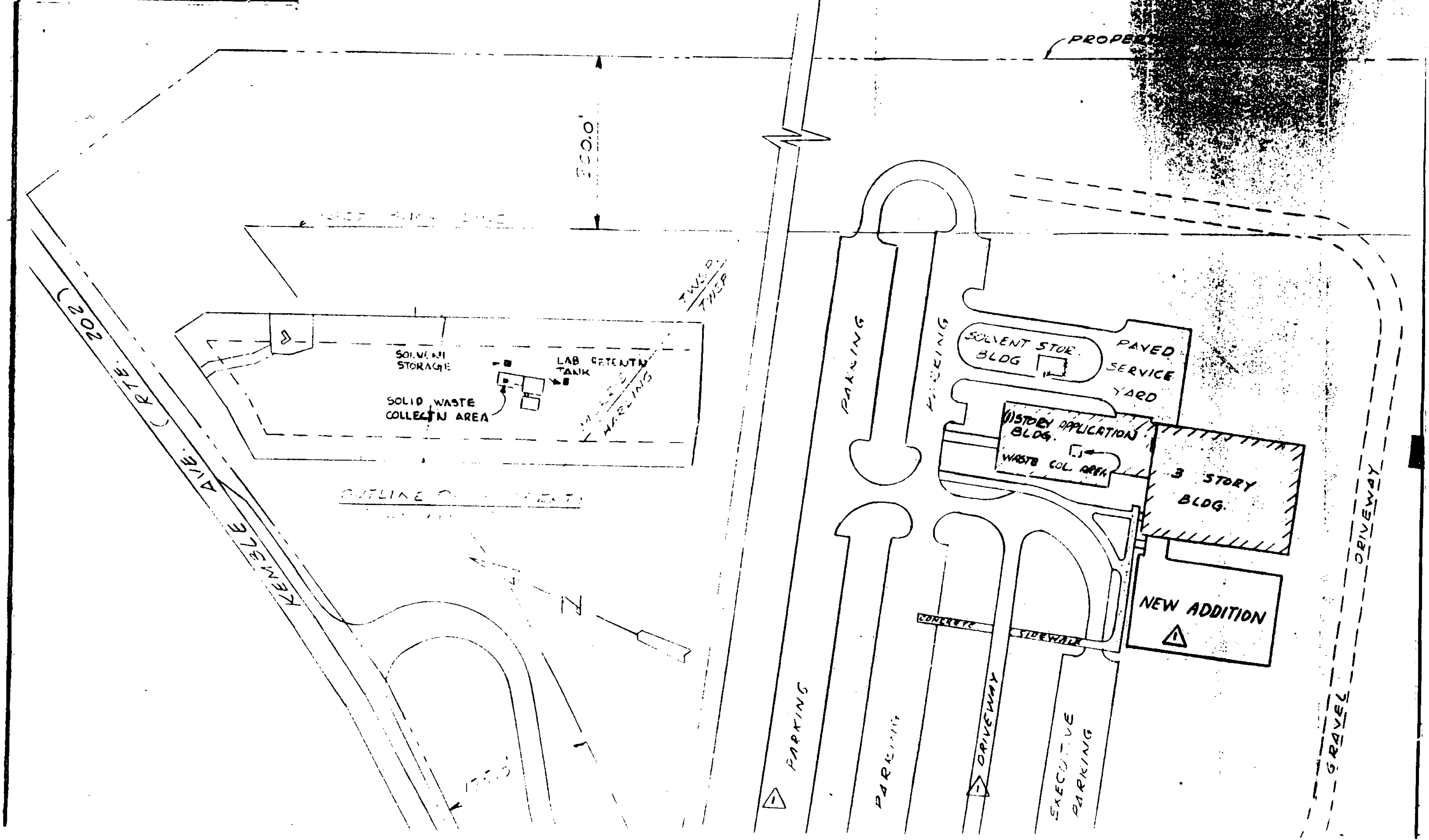
X. OPERATOR CERTIFICATION

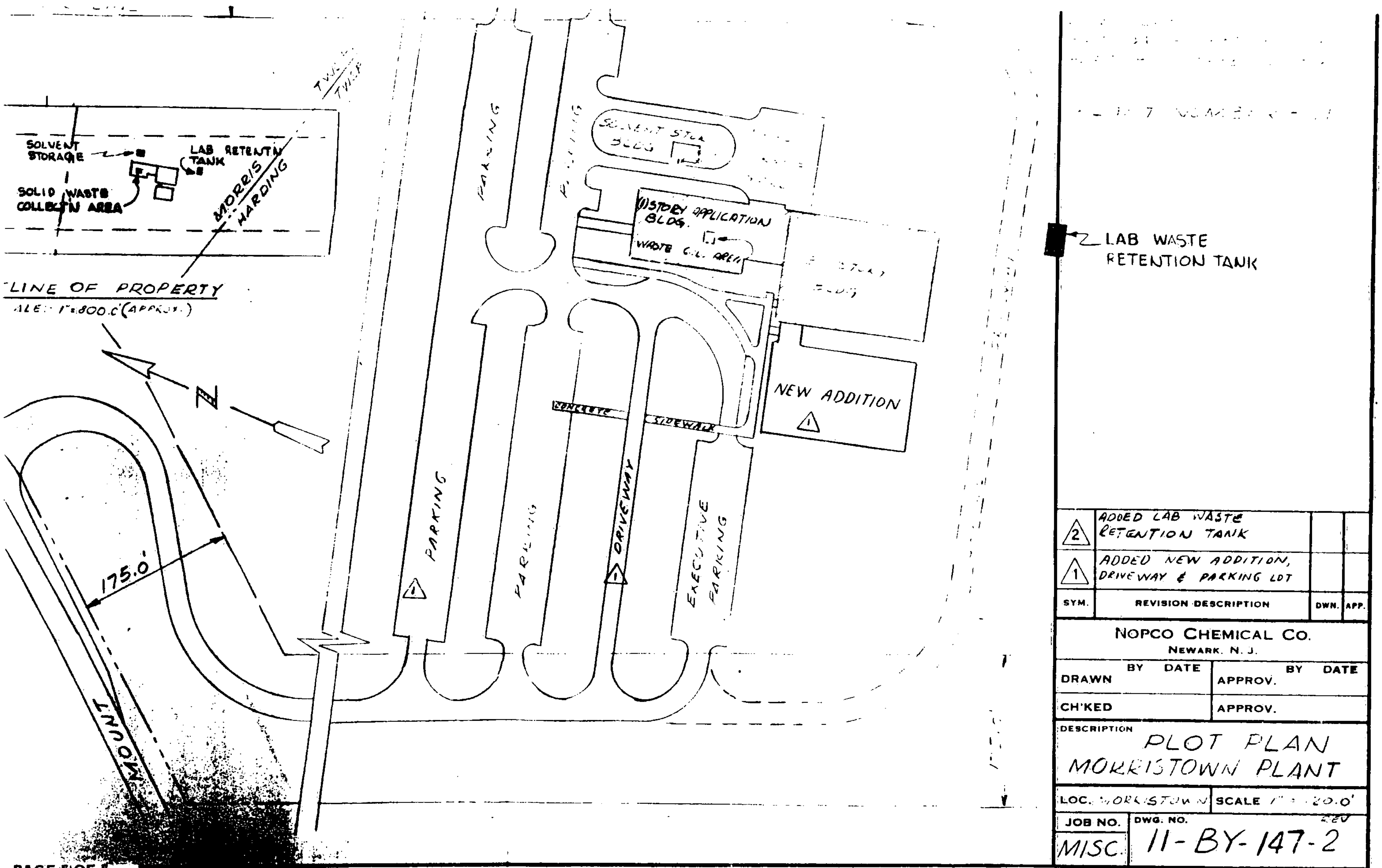
I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

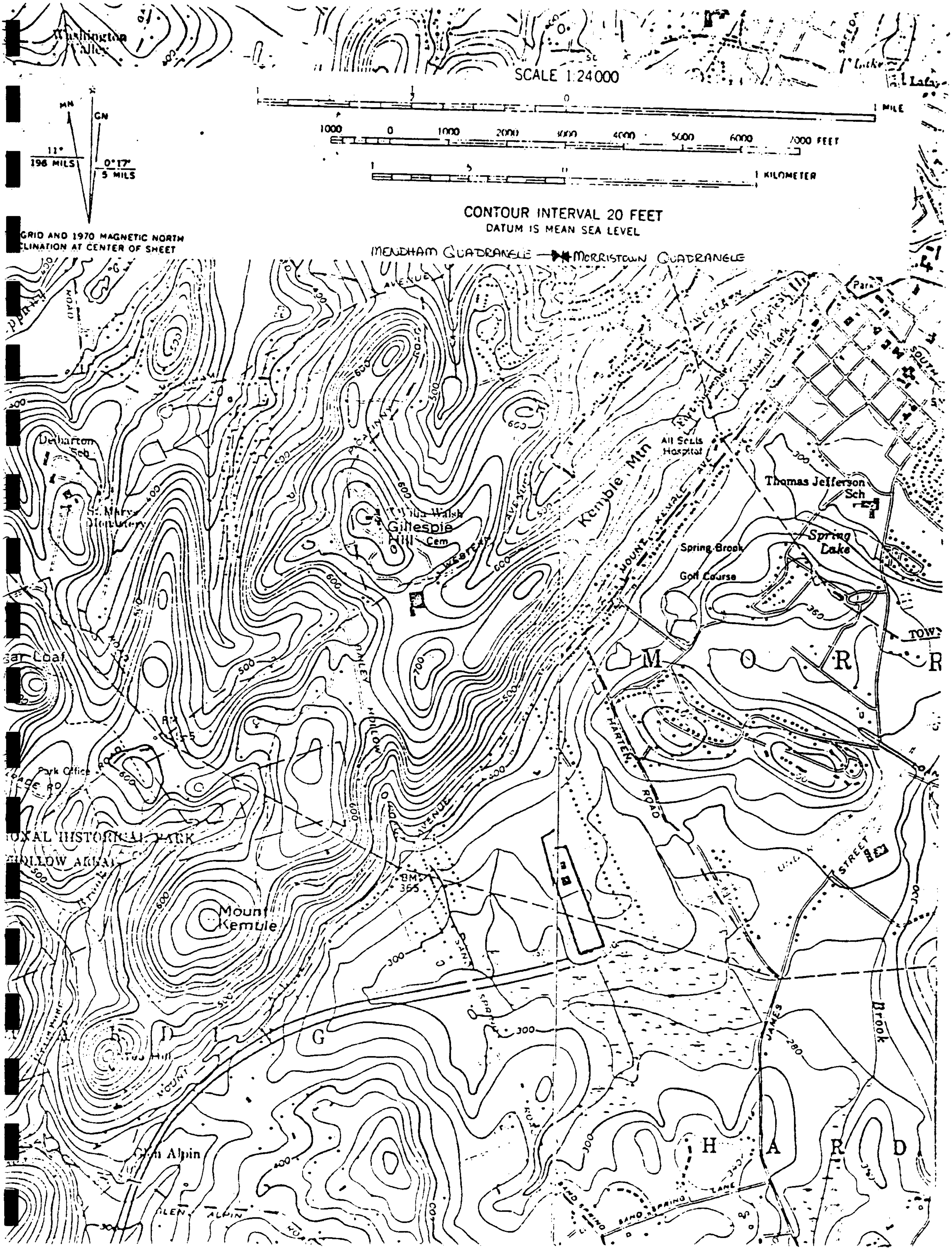
A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED

 CONTINUE ON PAGE 5

V. FACILITY DRAWING (see page 4)




SOLVENT STORAGE
LAB RETENTN TANK
SOLID WASTE COLLECTN AREA
MORRIS
HARDING
LINE OF PROPERTY
N
175.0'
MOUNT
PARKING
PARKING
PARKING
(1) STORY APPLICATION BLDG.
WASTE OIL AREA
NEW ADDITION
CONCRETE SIDEWALK
DRIVEWAY
EXECUTIVE PARKING
LAB WASTE RETENTION TANK
2 ADDED LAB WASTE RETENTION TANK
1 ADDED NEW ADDITION, DRIVEWAY & PARKING LOT
SYM. REVISION DESCRIPTION DWN. APP.
NOPCO CHEMICAL CO.
NEWARK, N. J.
DRAWN BY DATE APPROV. BY DATE
CH'KED APPROV.
DESCRIPTION PLOT PLAN MORRISTOWN PLANT
LOC. SCALE
JOB NO. MISC.
DWG. NO. 11-BY-147-2


SCALE 1:24000
1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER
CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL
GRID AND 1970 MAGNETIC NORTH
MN
GN
11°
196 MILS
0°17'
5 MILS
MENDHAM QUADRANGLE
MORRISTOWN QUADRANGLE
Gillespie Hill
Cem
Kemble Mtn
All Souls Hospital
Thomas Jefferson Sch
Spring Lake
Spring Brook
Golf Course
Park Office
Mount Kemble
Glen Alpin
Brook
M O R R
H A R D
BM 365
WESTERN AVENUE
MOUNT KEMBLE AVE
HARTER ROAD
JAMES
STREET
SOUTH
TOWN
GLEN ALPIN
SAND SPRING LANE
Park
Sch

REFERENCE NO. 6

Henkel HENKEL CORPORATION
ORGANIC PRODUCTS DIVISION

300 Brookside Avenue, Ambler, PA 19002
(215) 628-1000
Telex: 6851092AMCHM UW

June 1, 1987

Mr. Ernest J. Kuhlwein, Jr.
State of New Jersey
Department of Environmental Protection
Division of Hazardous Waste Management
401 East State Street
CN 028
Trenton, NJ 08625

Dear Mr. Kuhlwein:

Re: Change of Ownership — Morristown Facility NJD 052449022

Please find attached a revised Part A Form 1 and the Alternative Information Statement, which reflect the change of the Morristown facility NJD 052449022. This submittal is in response to your letter of May 11, 1987, requesting this information.

Previous Owner of Record:

Oxy Process Chemicals, Inc.
P. O. Box 4020
Darien, CT 06820

Previous Operator of Record:

Oxy Process Chemicals, Inc.
350 Mt. Kemble Avenue
Morristown, NJ 07960

Present Owner/Operator:

Henkel Process Chemicals, Inc.
350 Mt. Kemble Avenue, CN 1931
Morristown, NJ 07960

The person responsible for environmental affairs at the facility is:

Sandra Schillon, Laboratory Supervisor
(201) 267-1000

All other operations with respect to permitting requirements remain unchanged.

As per my discussions with Mr. George Mejia, of your department, you will be receiving verification of insurance coverage under separate cover. Should you have any further questions, please contact me at (215) 628-1417.

Sincerely,

Gary J. Shelby

Gary J. Shelby, P.E.
Environmental Engineer

GJS:mg
Attachment

(fill—in areas are spaced for elite type, i.e., 12 characters/inch).

Form Approved OMB No. 158-R0175

FORM 1 GENERAL

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

F N J D 0 5 2 4 4 9 0 2 2

LABEL ITEMS

I. EPA I.D. NUMBER

III. FACILITY NAME

V. FACILITY MAILING ADDRESS

VI. FACILITY LOCATION

PLEASE PLACE LABEL IN THIS SPACE

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill—in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill—in area(s) below. If the label is complete and correct, you need not complete Items I, III, V, and VI *(except VI-B which must be completed regardless)*. Complete all items if no label has been provided. Refer to the instructions for detailed item descriptions and for the legal authorizations under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental form listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of bold—faced terms.

SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED	SPECIFIC QUESTIONS	YES	NO	FORM ATTACHED
A. Is this facility a publicly owned treatment works which results in a discharge to waters of the U.S.? (FORM 2A)		X		B. Does or will this facility *(either existing or proposed)* include a concentrated animal feeding operation or aquatic animal production facility which results in a discharge to waters of the U.S.? (FORM 2B)		X	
C. Is this a facility which currently results in discharges to waters of the U.S. other than those described in A or B above? (FORM 2C)		X		D. Is this a proposed facility *(other than those described in A or B above)* which will result in a discharge to waters of the U.S.? (FORM 2D)		X	
E. Does or will this facility treat, store, or dispose of hazardous wastes? (FORM 3)	X			F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)		X	
G. Do you or will you inject at this facility any produced water or other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)		X		H. Do you or will you inject at this facility fluids for special processes such as mining of sulfur by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)		X	
I. Is this facility a proposed stationary source which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X		J. Is this facility a proposed stationary source which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an attainment area? (FORM 5)		X	

III. NAME OF FACILITY

1 SKIP HENKEL PROCESS CHEMICALS INC

IV. FACILITY CONTACT

A. NAME & TITLE (last, first, & title)	B. PHONE (area code & no.)
2 SCHILLON SANDRA LAB SUPERVISOR	201 267 1000

V. FACILITY MAILING ADDRESS

A. STREET OR P.O. BOX

3 350 MT KEMBLE AVENUE CN 1931

B. CITY OR TOWN	C. STATE	D. ZIP CODE
4 MORRISTOWN	NJ	07960

VI. FACILITY LOCATION

A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER

5 350 MT KEMBLE AVENUE CN 1931

B. COUNTY NAME

MORRIS

C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE (if known)
6 MORRISTOWN	NJ	07960	

VII. SIC CODES (4-digit, in order of priority)

A. FIRST		B. SECOND	
7 2843	(specify) Surface Active Agents	7 2899	(specify) Chemicals and Chemical Preparations, Not Elsewhere Classified

C. THIRD		D. FOURTH	
7 2869	(specify) Industrial Organic Chemicals Not Elsewhere Classified	7 2821	(specify) Plastic Materials and Resins

VIII. OPERATOR INFORMATION

A. NAME

HENKEL PROCESS CHEMICALS INC

B. Is the name listed in Item VIII-A also the owner? [X] YES [ ] NO

C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box: if "Other", specify.)

F = FEDERAL
S = STATE
P = PRIVATE
M = PUBLIC (other than federal or state)
O = OTHER (specify)

P (specify)

D. PHONE (area code & no.)

A 201 267 1000

E. STREET OR P.O. BOX

350 MT KEMBLE AVENUE CN 1931

F. CITY OR TOWN	G. STATE	H. ZIP CODE
MORRISTOWN	NJ	07960

IX. INDIAN LAND

Is the facility located on Indian lands? [ ] YES [X] NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water)	D. PSD (Air Emissions from Proposed Sources)	
N	9 P	
B. UIC (Underground Injection of Fluids)	**E. OTHER (specify)**	
U	9 25337	(specify) NJ DEP Plant ID Number
C. RCRA (Hazardous Wastes)	**E. OTHER (specify)**	
R NJD052449022	9	(specify)

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property bounderies. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS (provide a brief description)

At Henkel Process Chemicals, Inc., administrative and laboratory facilities, a number of activities occur such as sales and marketing, technical service, research and development, laboratory product testing, purchasing, data processing, and accounting. The products developed and tested are sold to a variety of markets including paper, textiles, paint, coatings, concrete, oil drilling, agriculture, cosmetics, plastics, rubber, adhesives, and tanning.

XIII. CERTIFICATION (see instructions)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE (type or print)	B. SIGNATURE	C. DATE SIGNED
Sandra J. Schillon Plant Coordinating Supervisor Neville McDonald, VP, Manuf.	Sandra J. Schillon	6/9/87 6/2/87

COMMENTS FOR OFFICIAL USE ONLY

Form 3510-1 (6-80) REVERSE

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WASTE MANAGEMENT
32 E. Hanover St., CN 028, Trenton, N.J. 08625

DR. MARWAN M. SADAT, P.E.
DIRECTOR

RICHARD C. SALKIE, P.E.
ASSOCIATE DIRECTOR

ALTERNATIVE INFORMATION STATEMENT

Under the New Jersey Administrative Code, Title 7, Chapter 26, Subchapter 12, Section 2(h)—N.J.A.C. 7:26-12.2(h)—the information required on this form must be submitted by any entity (individual, partnership, corporation) applying for a permit to operate a hazardous waste treatment, storage and/or disposal facility. This form and any necessary supplemental pages must be submitted along with a letter of intent at least ninety (90) days prior to formal permit application for the establishment of a new facility. For existing facilities (as defined by this Department), the form must be submitted ninety (90) days prior to the permit application.

All items must be addressed; if your response to any section is negative, so indicate by entering "none". If additional space is required for any section, append supplemental pages to this form and note the fact in the space provided in the referenced section.

Failure to submit this form with all required information will result in a delay in processing and reviewing your application as, under regulation, such procedures may not commence until a complete Alternative Information Statement has been received.

ALTERNATIVE INFORMATION STATEMENT

Name, address and identification of business concern seeking a permit:

NAME Henkel Process Chemicals, Inc. ADDRESS 350 Mt. Kemble Avenue Morristown, NJ 07960

NEW JERSEY STERN-TAX IDENTIFICATION NUMBER (if applicable) N/A

FEDERAL EMPLOYER IDENTIFICATION NUMBER (FEID) 95 4061821

++

SECTION I.a

Enter the names, addresses, positions, and Social Security Account Numbers (SSAN) of all officers, directors, or partners of the business concern seeking a permit:

Name	Address	Position	SSAN
Dieter H. Ambros	Larchenweg 7, D-4010	Chairman	413-64-3754
	Hilden, West Germany		
Harald P. Wulff	1131 Springmont Cir.	Director	556-86-4111
	Bryn Mawr, PA		
Howard W. Gross	18 Reiner Place	President	071-22-4104
	Englewood Cliffs, NJ		

if additional pages are appended, indicate page numbers here 3

++

SECTION I.b

Enter the names, addresses, and identification numbers (SSAN for individual, and Stern ID or FEID for business) of all persons or business concerns holding more than ten percent (10%) of the equity in, or more than ten percent (10%) of the liability of, the business concern seeking a permit:

Name	Address	ID Number
Henkel Corporation	300 Brookside Ave., Ambler, PA 19002	41-0957894

if additional pages are appended, indicate page numbers here ______

Section I.a - Continued

Name	Address	Position	SSAN
Ernest G. Szoke	482 Shady Retreat Rd. Doylestown, PA	Secretary	185-26-9692
Philip R. Mahaney	8 Stoney Hill Rd. Brookside, NJ	Treasurer	284-30-1644

REFERENCE NO. 7

NJD052449022

ENVIRONMENTAL PROTECTION AGENCY
HAZARDOUS WASTE PERMIT APPLICATION
CONSOLIDATED PERMITS PROGRAM
FORM 3 RCRA

VI. PHOTOGRAPHS

This envelope contains twenty (20) 3-1/2" x 5" black-and-white photographs of all existing hazardous waste storage facilities at this location:

a. Inside Solid Waste Handling Area - Applications Building

b. Outside Storage Shed "B"

c. Inactive Laboratory Waste Water Retention/ Aeration/Settling Pit Behind Fire Road of Main Building.

Submitted by: DIAMOND SHAMROCK CORPORATION
350 Mt. Kemble Avenue
Morristown, New Jersey 07960
201-267-1000

EPA Identification Number NJD052449022

10/28/80


221

1. SOLID WASTE HANDLING AREA (SWHA).

Closed cage on the right.
Additional drum storage area in aisle.

10-8-80

2. SOLID WASTE STORAGE AREA

Additional storage in the main aisle across from caged SWHA. Drums used to pack containerized lab waste.

10-8-80

3. SOLID WASTE HANDLING AREA

Full pails (with lab room number) are brought here for segregation and packing.

10-8-80

4. SOLID WASTE HANDLING AREA

Drums used to admix non-hazardous liquid lab waste and containerized non-hazardous lab waste in view. Also shelf holding hazardous chemical segregation pails.

10-8-80

4.

5. SOLID WASTE HANDLING AREA

Shelf holds "red" hazardous chemical segregation pails.

10-8-80

5

6. SOLID WASTE HANDLING AREA

Area behind cage used for storage of packing materials and vermiculite absorbent.

10-8-80



7. SOLID WASTE HANDLING AREA

Outside area North of cage can be used to store up to 10 full drums of chemical waste.

10-8-80

7

8. APPLICATIONS BUILDING

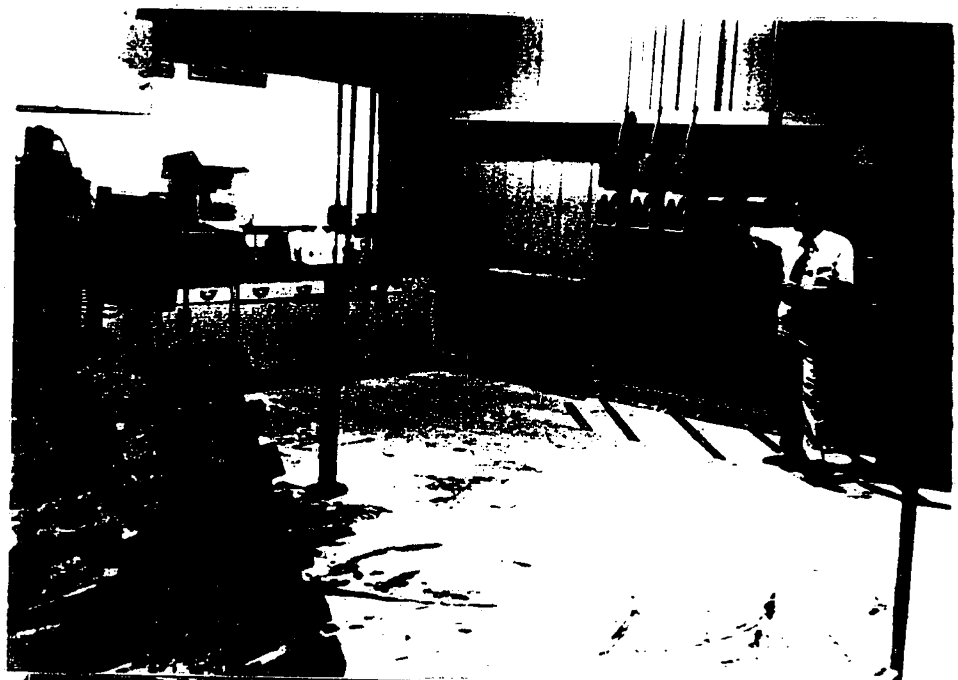
Textile area allows storage of 20 drums of chemical waste in event of an emergency.

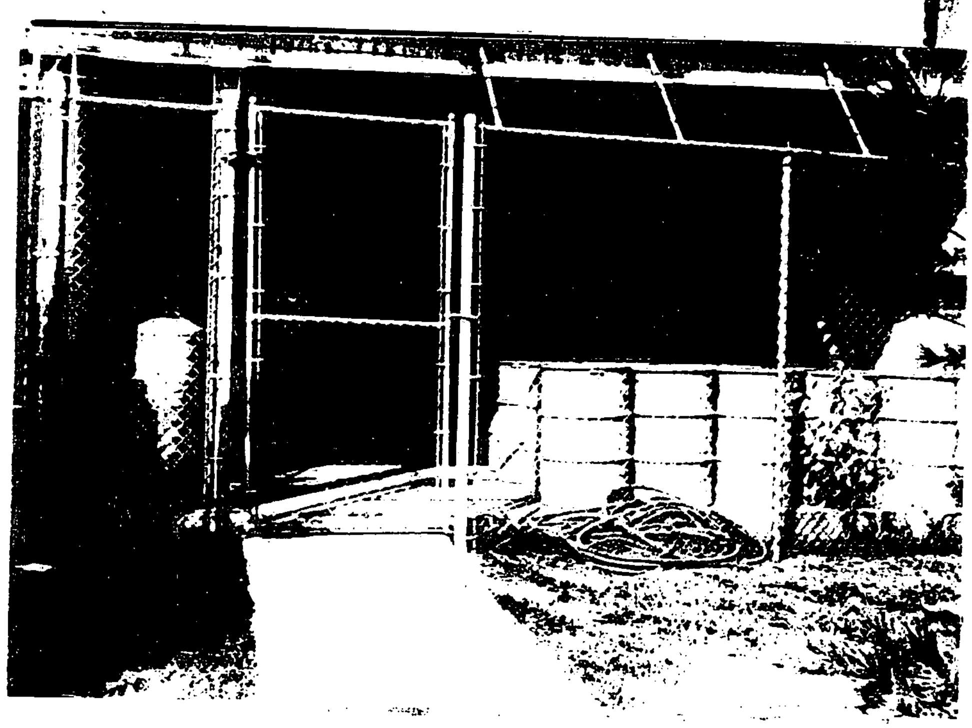
10-8-80

9. APPLICATIONS BUILDING

Tanning area allows storage of 15 drums of chemical waste in event of an emergency.

10-8-80





10. APPLICATIONS BUILDING

Water Treating area allows storage of 30 drums of chemical waste in event of an emergency.

10-8-80

10

11. APPLICATIONS BUILDING

Main aisle running past SWHA. Other open areas would permit storage of drums of chemical waste if needed.

10-8-80

11

12. OUTSIDE STORAGE SHED "B"

Front view of Shed "B", showing chainlink fence front, barbed wire protection on top and padlocked door.

10-8-80

12

13. OUTSIDE STORAGE SHED "B"

Showing drums of chemical waste ready for shipment to disposal site. Note: Other means of access on north side.

10-8-80

13

14. OUTSIDE STORAGE SHED "B"

Other half of shed available for drummed chemical waste storage.

10-8-80

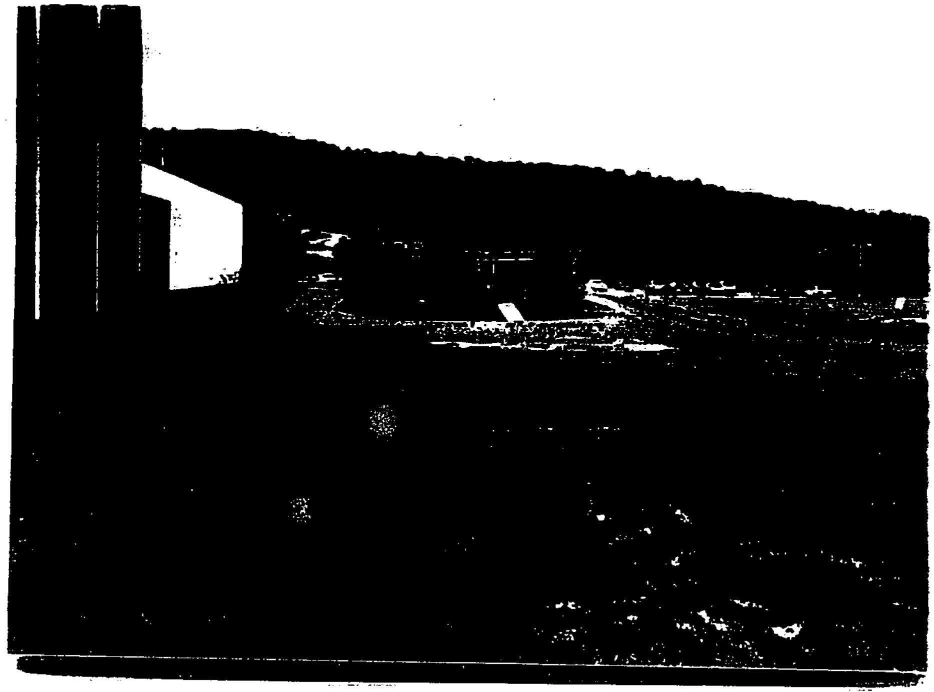
14

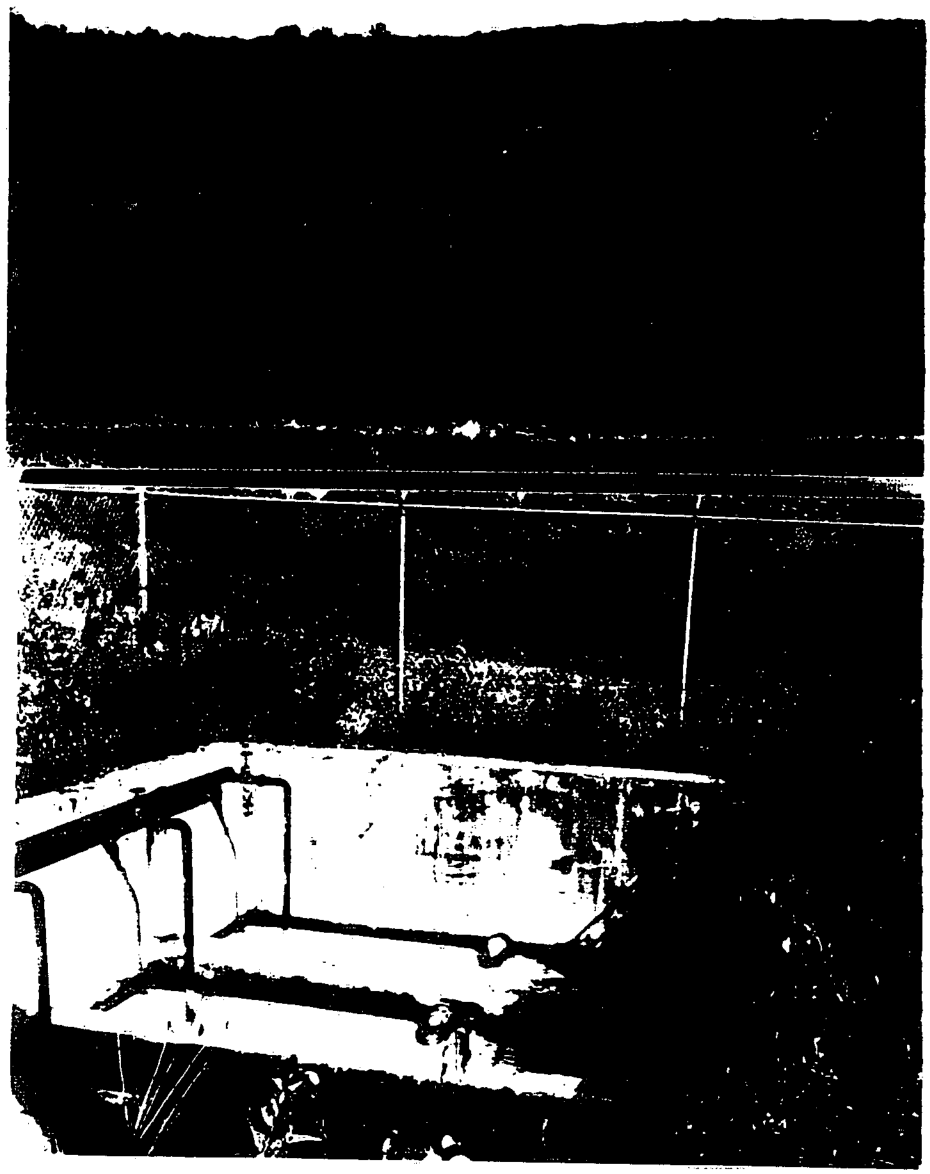
15. OUTSIDE STORAGE SHED "B"

Grounding cable has been run through from Shed "A" so working drums of waste solvent can be properly grounded.

10-8-80

15





17. OUTSIDE STORAGE SHED "B"

Showing its distance from the Applications Building, Main Building, and parking lot.

10-8-80

17

18. OUTSIDE RETENTION PIT

Head-on view of now-inactive lab waste water retention/aeration/ settling pit behind the fire road of Main Building.

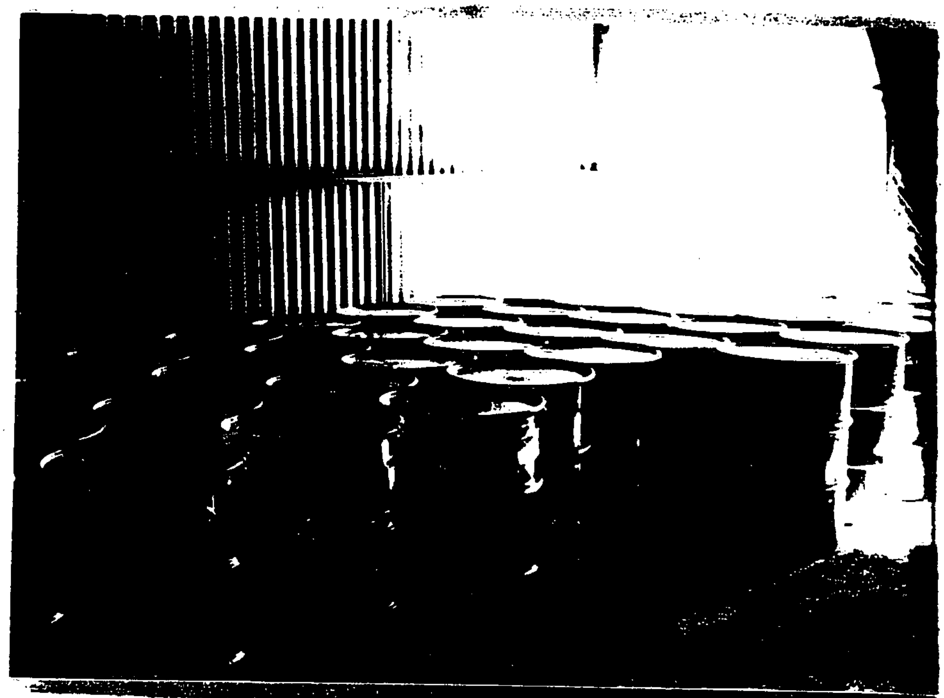
10-8-80

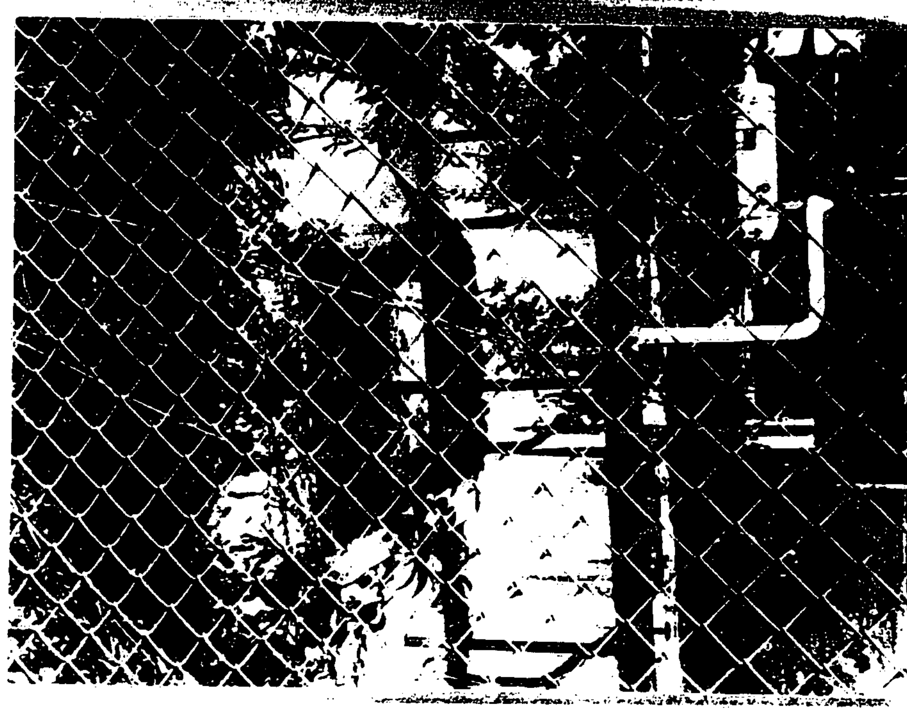
18

19. OUTSIDE RETENTION PIT

Empty concrete pit; area totally enclosed with high chainlink fence and a padlocked door.

10-8-80





16. OUTSIDE STORAGE SHED "B"

Accumulation of drums awaiting pickup for landfill disposal.

10-8-80

/6

20. OUTSIDE RETENTION PIT

Weed infested area surrounding concrete pit. Shows front access.

10-8-80

20

REFERENCE NO. 8

NUS CORPORATION AND SUBSIDIARIES TELECON NOTE

CONTROL NO:	DATE:	TIME:
02 8502-16	3/17/89	1015 am

DISTRIBUTION:

Oxy Process Chemicals, Inc. file

BETWEEN:	OF:	PHONE:
Mark Meyer	NJDEP Industrial Site Evaluation	(609) 633-7141

AND:

Gary Rojek

DISCUSSION:

Status of closure of Henkel Process Chemicals (Formerly Oxy Process Chemicals)

- Sampling of drum storage area soils and basins show that any contaminants were either background or below acceptable levels

- Lab waste retention basin contents were removed after cyanide problem was found to be background problem

- ~~Lab~~ Records show other lab retention tank was open 8 foot high tank that was divided into 3 compartments; no record of hazardous waste ever found in tank

ACTION ITEMS:

- Rollins Chemical removed contents of lab waste retention basin and lab retention tank in 1988

Gary Rojek 3/17/89

NUS 087 REVISED 0685

REFERENCE NO. 9

WS-fac

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WASTE MANAGEMENT
32 E. Hanover St., CN 028, Trenton, N.J. 08625

DR. MARWAN M. SADAT, P.E.
DIRECTOR

RICHARD C. SALKIE, P.E.
ASSOCIATE DIRECTOR

Hadley Bedbury
Diamond Shamrock Chemicals Company
1149 Ellsworth Drive
Pasadena, Tx 77501

23 APR 1986

Dear Mr. Bedbury:

RE: Delisting for Diamond Shamrock Chemicals Company, Morristown, NJ
NJD 052449022

The Department has reviewed the February 7, 1986 delisting request for Diamond Shamrock Chemicals Company, Morristown (the facility) from hazardous waste treatment, storage, and disposal (TSD) facility status to hazardous waste generator status.

On November 3, 1980, the facility filed a Part A permit application with the USEPA for greater than 90 days drum container storage at 5,500 gallons capacity.

On February 28, 1986, the facility was inspected by the Department. Hazardous waste drum storage for less than ninety (90) days occurs on a cement pad which is fenced and covered by a roof.

The facility identified by USEPA identification number NJD 052 449 022 is excluded from applicable TSD facility requirements under N.J.A.C.7:26-1 et.seq. provided that hazardous waste drum/container storage occurs for less than 90 days and the conditions for this exclusion under N.J.A.C.7:26-9.3, "Accumulation of Hazardous Waste for 90 Days or Less" are maintained by the facility. These conditions are as follows:

1. All such waste is, within 90 days or less, shipped off-site to an authorized facility or placed in an on-site authorized facility, as defined at N.J.A.C.7:26-1.4.

2. The waste is placed in containers which meet the standards of N.J.A.C. 7:26-7.2 and are managed in accordance with N.J.A.C.7:26-9.4(d).

23 APR 1986

3. The date upon which each period of accumulation begins is clearly marked and visible for inspection on each container.

4. The generator complies with the requirements for owners and operators of N.J.A.C.7:26-9.6 and 9.7 concerning preparedness and prevention, contingency plans and emergency procedures as well as N.J.A.C.7:26.9.4(g) concerning personnel training.

This written acknowledgement of the exclusion of the facility from the New Jersey Department of Environmental Protection's list of existing hazardous waste TSD facilities is based expressly on the review of the aforementioned correspondence. This letter makes no claim as to the extent and physical conditions of the actual hazardous waste activities occurring at the site mentioned above.

The issuance of this delisting letter by the Department does not indicate, or imply, and should not be construed as a waiver of any requirements pursuant to the New Jersey Water Pollution Control Act, N.J.S.A. 58:10A-1 et. seq. and regulations promulgated thereunder concerning the New Jersey Pollutant Discharge Elimination System, N.J.A.C. 7:14A-1 et. seq. If your facility is in any of the regulated categories identified in the above cited regulations, you are hereby directed to apply for any and all permits necessary within ninety days to the Bureau of Ground Water Discharge Permits, CN 029, Trenton, New Jersey, 08625.

Diamond Shamrock Chemical Company's hazardous waste facility above is no longer included in the Department's list of "existing facilities" (see N.J.A.C. 7:26-1.4 and 12.3) and therefore does not need to conform with the interim operating requirements of N.J.A.C.7:26-9 et. seq. for "existing facilities" which would include the TSD facility annual report. It is the facility's responsibility to operate within the conditions mentioned above. To operate a hazardous waste facility without prior approval from the Department is a violation of the Solid Waste Management Act N.J.S.A. 13:1E-1 et. seq.

If you have any questions on these matters, please contact my office at (609) 984-4892.

Very truly yours,

Frank Coolick, Chief
Bureau of Hazardous Waste Engineering

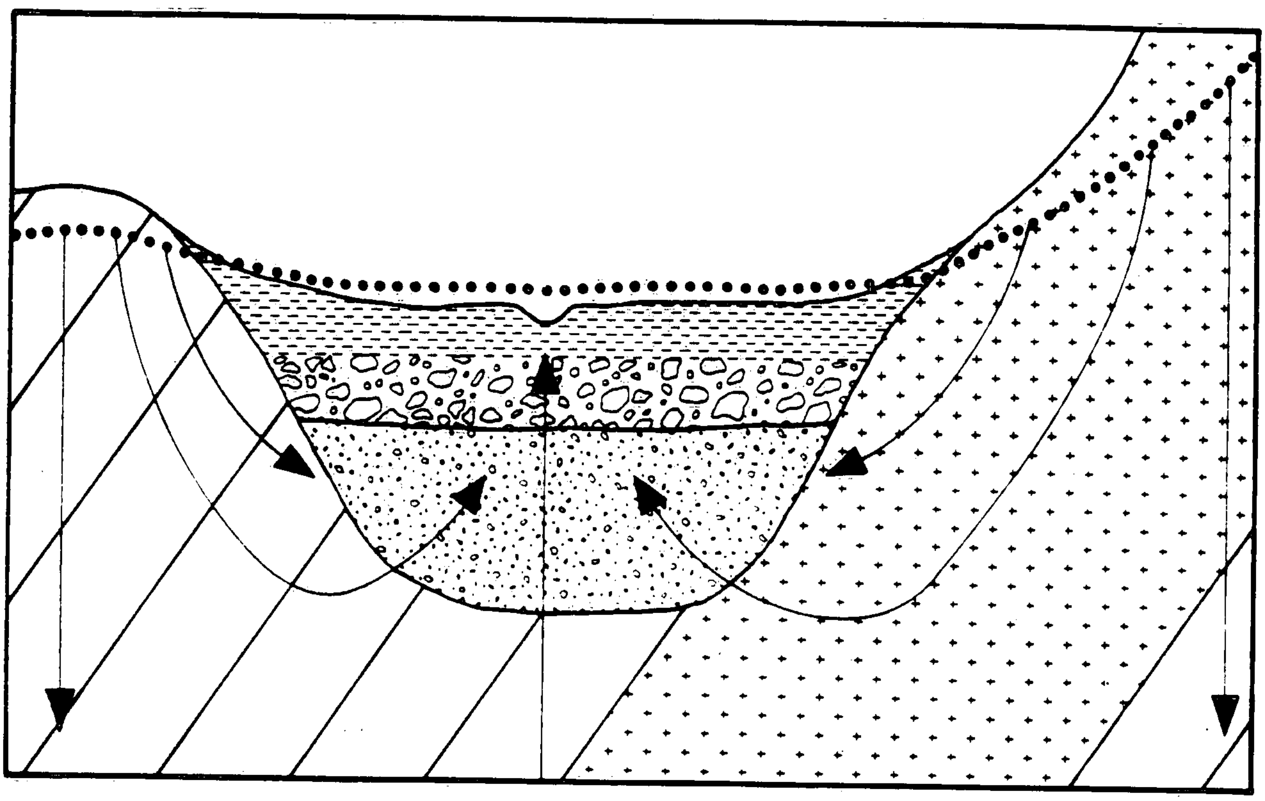
EP6:rr
c. Angel Chang, USEPA

REFERENCE NO. 10

COMPUTER SIMULATION MODEL OF THE PLEISTOCENE VALLEY-FILL AQUIFER IN SOUTHWESTERN ESSEX AND SOUTHEASTERN MORRIS COUNTIES, NEW JERSEY

U.S. GEOLOGICAL SURVEY

Water–Resources Investigations 76–25



Prepared in cooperation with

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER RESOURCES

COMPUTER SIMULATION MODEL OF THE PLEISTOCENE VALLEY-FILL AQUIFER IN SOUTHWESTERN ESSEX AND SOUTHEASTERN MORRIS COUNTIES, NEW JERSEY

By Harold Meisler

U.S. GEOLOGICAL SURVEY

Water–Resources Investigations 76–25

Prepared in cooperation with

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER RESOURCES

May 1976

COMPUTER SIMILATION MODEL OF THE
PLEISTOCENE VALLEY-FILL AQUIFER IN
SOUTHWESTERN ESSEX AND SOUTHEASTERN
MORRIS COUNTIES, NEW JERSEY

by

Harold Meisler

ABSTRACT

A finite-difference digital computer model was developed to simulate a buried valley-fill aquifer in southwestern Essex and southeastern Morris Counties, N.J. Withdrawal from this aquifer and from the adjacent consolidated-rock aquifer has increased from an estimated 5 million gallons per day (0.22 cubic metres per second) during the period 1900-29 to 28.5 million gallons per day (1.25 cubic metres per second) during the period 1972-73.

The valley-fill aquifer consists chiefly of outwash sand and gravel deposited in an interconnected series of valleys during the last glaciation. A total length of about 20 miles (32 kilometres) of valley-fill aquifer has been simulated. The aquifer is typically 0.5 to 1.5 miles (0.8 to 2.4 kilometres) wide and ranges in thickness from 0 to 100 feet (30 metres). Glacial till, lacustrine clay and silt, and swamp muck ranging in thickness from about 10 to 80 feet (3 to 24 metres) overlie the valley-fill aquifer and function as a confining layer.

The bedrock underlying and adjacent to the valley-fill aquifer belongs to the Newark Group of Triassic age. It consists of lava flows, referred to as Watchung Basalt, interbedded with shale and sandstone of the Brunswick Formation. The bedrock and valley-fill aquifer are in hydraulic connection.

The model simulates the valley-fill material as an artesian aquifer overlain by a semiconfining layer, but it allows for conversion to water-table conditions when the water level falls below the top of the aquifer. The bedrock between the valley-fill deposits is represented as an unconfined aquifer in which saturated thickness remains much greater than drawdown and its transmissivity can therefore be considered constant. It is assumed that a lateral hydraulic connection exists between the bedrock aquifer and the valley-fill aquifer along the valley walls but that bedrock beneath the valley-fill aquifer is impermeable.

Values of hydraulic properties of the valley-fill aquifer used in the model are: hydraulic conductivity, 3×10^{-3} to 4×10^{-3} feet per second (78 to 105 metres per day) and specific storage, 4×10^{-6} ft^{-1} (1.2×10^{-6} m^{-1}). A specific yield of 0.16 is used if the simulated water level drops below the top of the aquifer during computer runs. Hydraulic conductivity of the semiconfining layer overlying the valley-fill aquifer, as used in the model, ranges from 7×10^{-8} to 4.9×10^{-7} feet per second (1.8×10^{-3} to 1.3×10^{-2} metres per day). Release of water from storage in the semiconfining layer was not simulated.

Values of hydraulic properties of the bedrock aquifer used in the model are: hydraulic conductivity, 3.6×10^{-5} to 6.0×10^{-5} feet per second (0.94 to 1.58 metres per day); thickness, 500 feet (152.4 metres); and coefficient of storage, or specific yield, 0.12.

The model was calibrated by simulating the pumpage from 1900 through 1971. For purposes of simulation this time interval was divided into seven pumping periods ranging from 3 to 19 years in duration. Calibration was based on comparison of computed water-level declines with declines measured in 12 observation wells during the latter part of the pumping history. Calibration of the model was more successful at some localities than at others. The model is adequately calibrated to be used for planning and predictive purposes for valley-fill aquifers in the East Hanover, Chatham, and Southern Millburn Valleys. The model is not calibrated or is poorly calibrated for valley-fill aquifers in the Northern Millburn, Slough Brook, and Canoe Brook Valleys.

The model has been used to determine pumpage available from the valley-fill aquifer, based upon the criterion that water levels would stabilize at least 30 feet (9.1 metres) above the base of the aquifer. On this basis, the model indicates that pumpage of approximately 40 million gallons per day (1.8 cubic metres per second) or about 40 percent more than the 1972-73 rates could be obtained on a continuing basis. All this increase would have to occur in the East Hanover and Chatham Valleys. In the other valleys, the amount of water pumped during 1972-73 either equals (Southern Millburn Valley) or exceeds the anticipated pumpage availability (Northern Millburn, Slough Brook, and Canoe Brook Valleys).

INTRODUCTION

Purpose and Scope

Sand and gravel deposits of Pleistocene age have been an important source of water for communities and industries in southwestern Essex and southeastern Morris Counties (fig. 1) for several decades. Withdrawal from these deposits has increased from an estimated 5 Mgal/d (million gallons per day) [0.22 m^3/s (cubic metres per second)] during the period 1900-29 to approximately 28.5 Mgal/d (1.25 m^3/s) during the period 1972-73. Yet

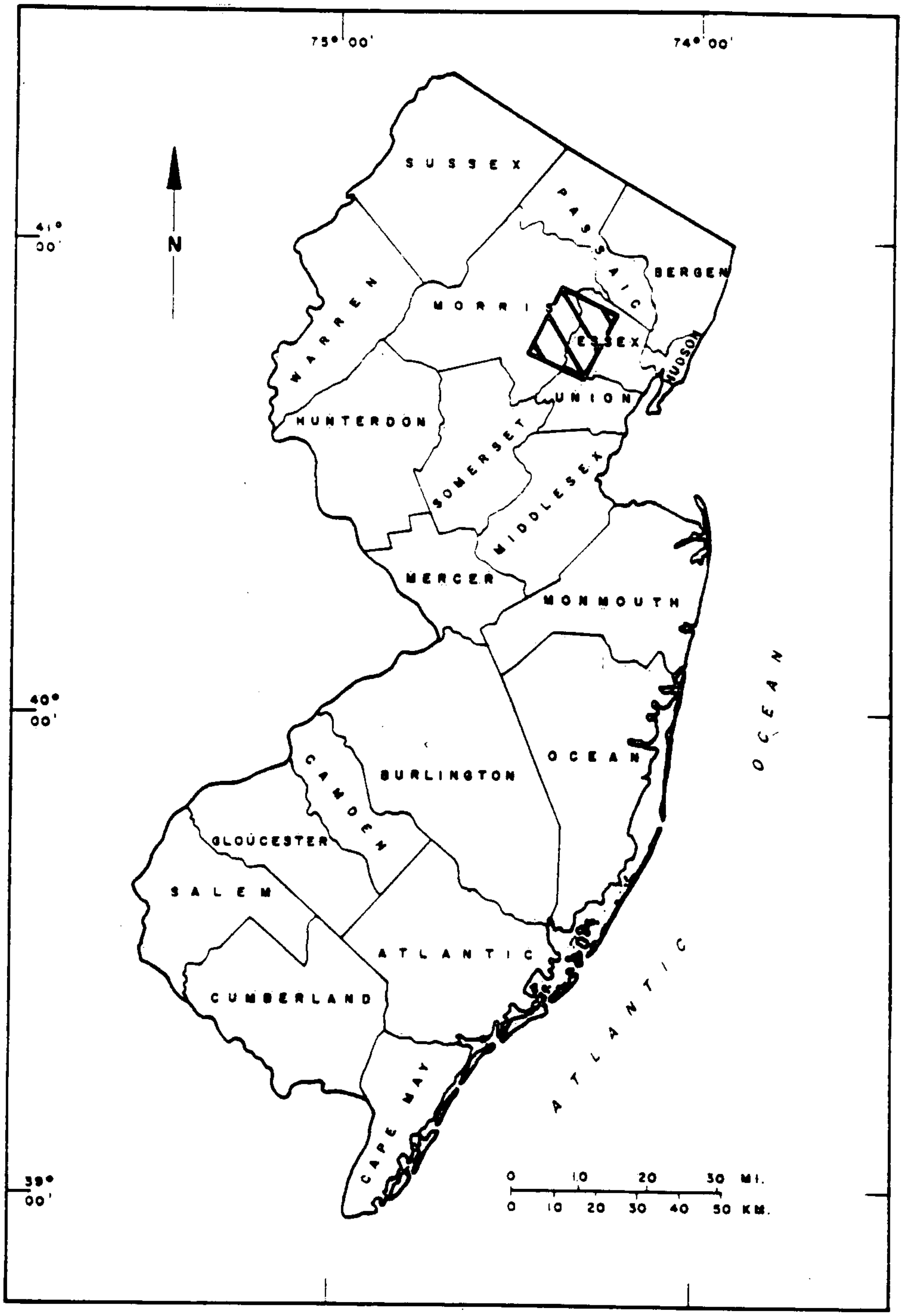


Figure 1.--Map of New Jersey showing location of study area.

virtually all this water was withdrawn from a buried valley-fill aquifer occupying (fig. 2 and plate 1) an area of approximately 20 mi^2 (square miles) [52 km^2 (square kilometres)].

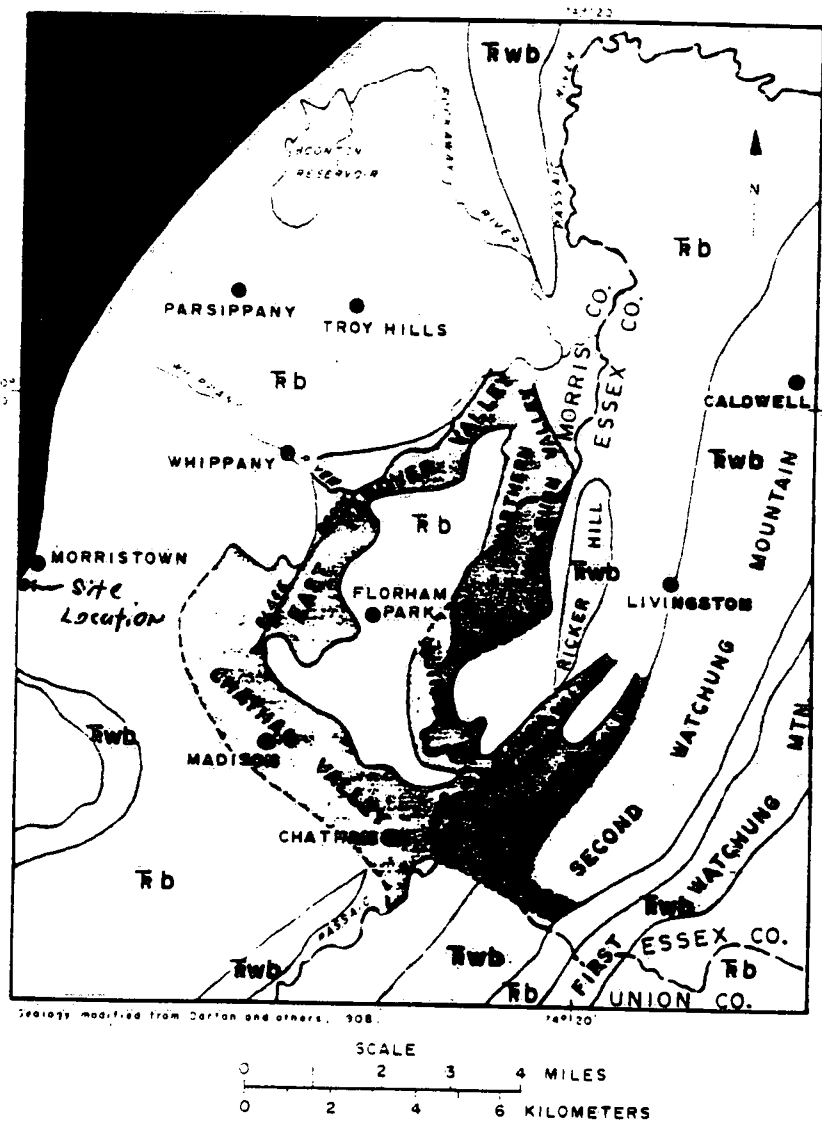
Because of increasing withdrawals accompanied by water-level declines, State and municipal officials and water-resources planners are concerned that the valley-fill aquifer may be overpumped locally. They wish to know where additional ground-water development can take place and how much ground water is available for future development. The purpose of the present study by the U.S. Geological Survey in cooperation with the Division of Water Resources of the New Jersey Department of Environmental Protection is to make a quantitative hydrologic analysis of the known buried valley-fill aquifer in southwestern Essex and southeastern Morris Counties in order to provide water-resources planners with the hydrologic basis to plan ground-water development and to allocate available water. The analysis is done by using a computer simulation model to provide estimates of the hydrologic effects of future ground-water development. The model simulates an area of approximately 50 mi^2 (130 km^2) which includes not only the area of the buried valley fills but also adjacent land underlain by bedrock of Triassic age (plate 1).

Geographic Setting

Southwestern Essex and southeastern Morris Counties are located within the Triassic lowlands of the Piedmont Province. The area covered by the computer simulation model lies within the Passaic River basin. Most of the buried valley fills trend northeast-southwest and occur in topographically low areas beneath stream valleys and marshes (plate 1).

The East Hanover Valley fill (valley names from Nichols, 1968a) underlies Black Meadows, Black Brook, and the Whippany River. The Millburn Valley fill underlies, in part, the Passaic River. Smaller buried valley fills (not named by Nichols, 1968a) occur beneath Slough Brook and Canoe Brook. The Chatham Valley fill runs transverse to the other valley fills and does not coincide with a topographic valley. It underlies and parallels, in part, a northwest-southeast trending terminal moraine.

Altitudes of land surface overlying the buried valley fills typically range from 180 to 240 ft [55 to 73 m]. The land surface is higher, 200 to 360 ft (60 to 110 m), where the Chatham Valley fill is overlain by terminal moraine. Topographically higher areas underlain by bedrock of Triassic age flank the buried valleys. The altitude of the bedrock area between the buried valley fills ranges from 200 to 280 ft (60 to 85 m). West of the East Hanover Valley fill, the altitude of hills in the area underlain by the Brunswick Formation is generally 300 to 420 ft (90 to 128 m). East of Millburn, Slough Brook, and Canoe Brook Valley fills, the altitude of Watchung Mountain, underlain by Watchung Basalt, is as much as 640 ft (195 m).



EXPLANATION

QUATERNARY

Valley fill

Sand and gravel overlain by glacial till, clay, and silt.

NEWARK GROUP — TRIASSIC

Ŧb

Brunswick Formation

Sandstone and shale

Ŧwb

Watchung Basalt

Rocks are thinly mantled by till in most areas and may contain valley fill that is not yet delineated.

PRECAMBRIAN

Gneiss

Figure 2.--Generalized geologic map of southwestern Essex and southeastern Morris counties.

Acknowledgments

The author is indebted to the many municipal water departments, water companies, and industrial firms that furnished data on ground-water withdrawals. Especially helpful were Florham Park Water Department, Madison Water Department, Allied Chemical Corp., Livingston Township Water Department, Esso Research and Engineering Co., and East Orange Water Department.

HYDROGEOLOGY

Introduction

Bedrock in the area of this study comprises the Brunswick Formation and Watchung Basalt of the Newark Group of Late Triassic age. Unconsolidated sand, clay, and gravel deposits of glacial, fluvial, and lacustrine origin of Pleistocene and Holocene age overlie bedrock throughout the area.

Figure 3 shows a generalized geohydrologic section extending from northwest to southeast through the study area, illustrating the disposition of the major lithologic units and the nature of the ground-water flow pattern prior to pumping. The valley-fill aquifers are deposits of glacial outwash sand and gravel occupying preexisting valleys in the bedrock surface and overlain by semipermeable deposits of till, clay, silt, and swamp muck. Water occurs under unconfined conditions in the bedrock and under confined conditions in the valley-fill aquifers. Ground-water movement is generally from the high areas toward areas of discharge in the valleys. The discharge originally occurred entirely as seepage through the semiconfining layers, into swamps and streams, as shown in figure 3. At the present time, discharge by wells tapping the valley-fill aquifers has diverted some of the natural discharge. In some localities there has been a reversal of flow in the semiconfining materials, which now conduct leakage from the surface sources to the underlying aquifer.

Consolidated Rocks

The Brunswick Formation underlies most of the area (fig. 2). It consists of interbedded brown, reddish-brown, and gray shale, sandy shale, sandstone, and some conglomerate. Total thickness of the Brunswick Formation probably exceeds 6,000 ft (1,830 m) (Nichols, 1968b, p. 5). Three sheets of gray to black basalt are intercalated with beds of the Brunswick Formation. The middle sheet, which forms Second Watchung Mountain, occurs along the east edge of the study area in Essex County (fig. 2 and plate 1). The uppermost basalt sheet forms a discontinuous ridge called Ricker Hill in the study area. Each of the basalt sheets is made up of several lava flows. Scoriaceous zones occur at the top of many of the individual flows. The Watchung Basalt in Second Watchung Mountain ranges from 750 to 900 ft (230-275 m) in thickness; the uppermost Watchung Basalt ranges from 225 to 350 ft (70-105 m) in thickness (Nichols, 1968b, p. 6). Sedimentary rocks and basalt sheets of the Newark Group dip west-northwest at about 10 degrees.

The Newark Group is capable of yielding large quantities of water to wells. Yields of wells tapping the Brunswick Formation in Essex County reported by Nichols (1968b p. 13) range from 35 to 820 gal/min (gallons per minute) [2.2 to 52 l/s (litres per second)] and average 364 gal/min (23 l/s). Yields of wells tapping the Watchung Basalt in Essex County range from 7 to 400 gal/min (0.4 to 25 l/s) and average 116 gal/min (7.3 l/s) Nichols, 1968b, p. 13). Transmissivity of the Newark Group in Morris County is typically between 2,700 and 4,000 ft^2/d (250 and 370 m^2/d). The average coefficient of storage is about 0.0005 (Gill and Vecchioli, 1965, p. 23).

Water in the Newark Group largely occurs in the numerous fractures that intersect the rocks. This is especially true of the shale beds. Additional void space is provided in the sandstone beds where cementing material is lacking. Vesicles in the basalt add to the porosity resulting from the fractures. The best producing wells tapping the Brunswick Formation are for the most part between 300 and 400 ft (90 and 120 m) deep.

Unconsolidated Deposits

The unconsolidated deposits of Pleistocene age can be divided (Nichols, 1968b, p. 6, 20) into two general categories; stratified drift and unstratified drift. The stratified drift includes buried valley fills of advance outwash and lacustrine silt and clay. The unstratified drift includes till or ground moraine and terminal moraine. Swamp muck of more recent age underlies most valley bottoms.

Buried valley fill of advance outwash sand and gravel occupies preexisting valleys in southeastern Morris and southwestern Essex Counties (fig. 2). This valley fill constitutes the principal aquifer system in the area of this investigation (fig. 3). The valley-fill aquifer is as thick as about 100 ft (30 m). The width of the buried valley fills ranges from about 0.5 to 1.5 mi (0.8 to 2.5 km) wide. Several of the buried valleys were named by Nichols (1968a). These are: East Hanover Valley, trending northeast-southwest in the western part of the study area; Chatham Valley, in the southern part of the area; and Millburn Valley in the eastern part of the area. Because of insufficient data, Nichols (1968a) did not connect the Millburn Valley in the northern part of the area with the Millburn Valley in the southern part. The two parts were joined for the simulation because of the strong probability that they are joined in actuality.

The terminal moraine, which marks the southernmost extent of Wisconsin Glaciation, forms a northwest-southeast-trending ridge along the southwestern border of the study area (plate 1). The top of the terminal moraine is generally about 160 ft (50 m) higher than the surface of the much thinner till, which covers the study area north of the terminal moraine. The till, in conjunction with lacustrine and swamp deposits, functions as an overlying confining layer for the valley-fill aquifer. Thickness of this confining layer ranges from about 10 ft (3 m) in the northern part of the study area to about 80 ft (24 m) in the vicinity of Madison and Chatham. The till overlying the Triassic rocks is generally less than

Table 1. Ground-water withdrawal in southwestern Essex and southeastern Morris Counties
(Sources of data: New Jersey Division of Water Resources; individual well owners; and Thompson, 1932)

Owner's name and well number	Location		Average pumping rate, in ft^3/s							Aquifer
	Row	Column	1900-29	1930-45	1946-52	1953-59	1960-65	1966-68	1969-71	
Livingston Township Water Dept. No. 2	7	40				0.01 *	0.033	0.05	0.37	Brunswick Formation
Livingston Township Water Dept. No. 1	8	38			0.80 *	.20 *	.26	.15	.12	Brunswick Formation
Livingston Township Water Dept. No. 3	9	27				1.00 *	1.87	1.49	1.30	Valley fill, Northern Millburn Valley
Livingston Township Water Dept. No. 5	10	28					.50	.65	.76	Valley fill, Northern Millburn Valley
Livingston Township Water Dept. No. 4	13	42				.02 *	.25	.42	.29	Brunswick Formation
East Hanover Township Water Dept. No. 1	14	14						.07	.57	Valley fill, East Hanover Valley
Livingston Township Water Dept. No. 6	14	32						.06	.23	Valley fill, Northern Millburn Valley
Suburban Propane	15	8		0.001*	.005*	.007*	.008	.008	.008	Valley fill, East Hanover Valley
Livingston Township Water Dept. No. 7	15	27						.24	.51	Valley fill, Northern Millburn Valley
Sandoz Inc. No. 1	16	13			.08 *	.10 *	.11**	.18	.23	Valley fill, East Hanover Valley
Sandoz Inc. No. 2	17	14			.08 *	.10 *	.11**	.08	.19	Valley fill, East Hanover Valley
Sandoz Inc. No. 3	18	15			.12 *	.18 *	.23**	.31	.43	Valley fill, East Hanover Valley
Livingston Township Water Dept. No. 8	18	34							.04	Valley fill, Northern Millburn Valley

* Estimated
** Pumpage at this node has not been reported. Value given is estimated from total pumpage for several nodes.
Location of wells shown in plate 1.

Table 1. Ground-water withdrawal in southwestern Essex and southeastern Morris Counties--Continued

(Sources of data: New Jersey Division of Water Resources; individual well owners; and Thompson, 1932)

Owner's name and well number	Location		Average pumping rate, in ft^3/s							Aquifer
	Row	Column	1900-29	1930-45	1946-52	1953-59	1960-65	1966-68	1969-71	
Sandoz Inc. No. 4	19	15							0.29	Valley fill, East Hanover Valley
Sandoz Inc. No. 5	20	13							.19	Valley fill, East Hanover Valley
Morristown Water Dept., Black Brook No. 1	22	12							.59**	Valley fill, East Hanover Valley
E. Orange Water Dept., Canoe Brook No. 4	22	45				0.05**	0.20**	0.17	.90	Valley fill, Canoe Brook Valley
Wilbur B. Driver Co.	23	14					.02	.05	.21	Valley fill, East Hanover Valley
Morristown Water Dept., Black Brook No. 2	24	12							.59**	Valley fill, East Hanover Valley
E. Orange Water Dept., Canoe Brook No. 3	24	45				.05**	1.00**	1.13	.76	Valley fill, Canoe Brook Valley
Florham Park Water Dept. No. 2	26	17				.32**	.50**	.58	.75	Valley fill, East Hanover Valley
Florham Park Water Dept. No. 3	26	20						.07	.013	Valley fill, East Hanover Valley
E. Orange Water Dept. Slough Brook Well Field	27	41	0.10 *	0.18**	0.16**	.30**	.07**	.21**	.17**	Valley fill, Slough Brook Valley
E. Orange Water Dept., Canoe Brook No. 2	27	45				.10**	1.40**	1.38	.95	Valley fill, Canoe Brook Valley
E. Orange Water Dept., Slough Brook Well Field	28	41	.10**	.18**	.16**	.30**	.07**	.21**	.17**	Valley fill, Slough Brook Valley
Florham Park Water Dept. No. 1	29	18		.16	.30	.30**	.50**	.56	.58	Valley fill, East Hanover Valley

* Estimated
** Pumpage at this node has not been reported. Value given is estimated from total pumpage for several nodes.

Location of wells shown in plate 1.

Table 1. Ground-water withdrawal in southwestern Essex and southeastern Morris Counties--Continued

(Sources of data: New Jersey Division of Water Resources; individual well owners; and Thompson, 1932)

Owner's name and well number	Location		Average pumping rate, in ft^3/s							Aquifer
	Row	Column	1900-29	1930-45	1946-52	1953-59	1960-65	1966-68	1969-71	
E. Orange Water Dept., Braidburn No. 3	29	29	0.20 *	0.60**	1.40**	1.40**	1.36**	1.74	2.08	Valley fill, Southern Millburn Valley
E. Orange Water Dept., Slough Brook Well Field	29	41	.10 *	.18**	.16**	.30**	.07**	.21**	.17**	Valley fill, Slough Brook Valley
E. Orange Water Dept., Braidburn No. 2	30	30	.20 *	.60**	1.20**	1.20**	1.15**	1.51	1.42	Valley fill, Southern Millburn Valley
E. Orange Water Dept., Canoe Brook No. 1	30	45	2.20 *	4.30	3.40	3.00**	1.40**	.37	.48	Valley fill, Canoe Brook Valley
Morristown Water Dept., Normandy Well	31	6	.10 *	.30	.40	.50	.35	.27	.18	Valley fill, East Hanover Valley
E. Orange Water Dept., Braidburn No. 1	31	30	.20 *	.40**	.70**	.70**	.65**	.84	1.42	Valley fill, Southern Millburn Valley
E. Orange Water Dept., Dickinson No. 3	32	34	.20 *	.50**	.80**	1.30**	1.40**	1.65	2.09	Valley fill, Southern Millburn Valley
Allied Chemical Co.	33	5					.38 *	.40	.42	Valley fill, Chatham Valley
E. Orange Water Dept., Dickinson No. 1	33	31	.20 *	.50**	.80**	1.30**	1.40**	1.58	1.93	Valley fill, Southern Millburn Valley
E. Orange Water Dept., Dickinson No. 2	34	33	.20 *	.40**	.60**	.60**	.60**	.66	.52	Valley fill, Southern Millburn Valley
Orange Products, Inc.	34	38					.04 *	.17	.17	Valley fill, Southern Millburn Valley
Esso Research and Engineering No. 1	35	12				.10 *	.45	.59	.54	Valley fill, Chatham Valley

* Estimated

** Pumpage at this node has not been reported. Value given is estimated from total pumpage for several nodes.

Location of wells shown in plate 1.

Table 1. Ground-water withdrawal in southwestern Essex and southeastern Morris Counties--Continued

(Sources of data: New Jersey Division of Water Resources; individual well owners; and Thompson, 1932)

Owner's name and well number	Location		Average pumping rate, in ft^3/s							Aquifer
	Row	Column	1900-29	1930-45	1946-52	1953-59	1960-65	1966-68	1969-71	
Commonwealth Water Co., Canoe Brook Well Field	36	39	0.30 *	0.33**	0.50**	0.63**	0.84**	0.74**	0.77**	Valley fill, Southern Millburn Valley
Commonwealth Water Co., Canoe Brook Well Field	36	41	.30 *	.33**	.50**	.63**	.84**	.74**	.77**	Valley fill, Southern Millburn Valley
Commonwealth Water Co., Canoe Brook Well Field	36	42	.90 *	1.00**	1.50**	1.89**	2.53**	2.21**	2.30**	Valley fill, Southern Millburn Valley
Commonwealth Water Co., Canoe Brook Well Field	36	43	.60 *	.67**	1.00**	1.26**	1.69**	1.48**	1.54**	Valley fill, Southern Millburn Valley
Morris Co. Golf Club	37	5					.001*	.05	.05	Valley fill, Chatham Valley
Commonwealth Water Co., Canoe Brook Well Field	37	43	.80 *	1.00**	1.50**	1.89**	2.53**	2.21**	2.30**	Valley fill, Southern Millburn Valley
Commonwealth Water Co., Canoe Brook Well Field	38	43	.60 *	.67**	1.00**	1.36**	1.69**	1.48**	1.54**	Valley fill, Southern Millburn Valley
Madison Water Dept., Well C	40	17				.20**	.86	.54	.49	Valley fill, Chatham Valley
Madison Water Dept., Well D	41	19					.16	.69	.45	Valley fill, Chatham Valley
Commonwealth Water Co., Passaic R. No. 51	43	37				1.00 *	1.57**	1.34**	1.44**	Valley fill, Southern Millburn Valley
Commonwealth Water Co. Passaic R. Nos. 48, 50	44	38				2.00 *	3.14**	2.68**	2.88**	Valley fill, Southern Millburn Valley
Madison Water Dept., Well B, No. 1-12	45	25	.20 *	.50 *	.67**	.40**	.81	.65	.75	Valley fill, Chatham Valley

* Estimated
** Pumpage at this node has not been reported. Value given is estimated from total pumpage for several nodes.

Location of wells shown in plate 1.

Table 1. Ground-water withdrawal in southwestern Essex and southeastern Morris Counties--Continued
(Sources of data: New Jersey Division of Water Resources; individual well owners; and Thompson, 19[illegible]2)

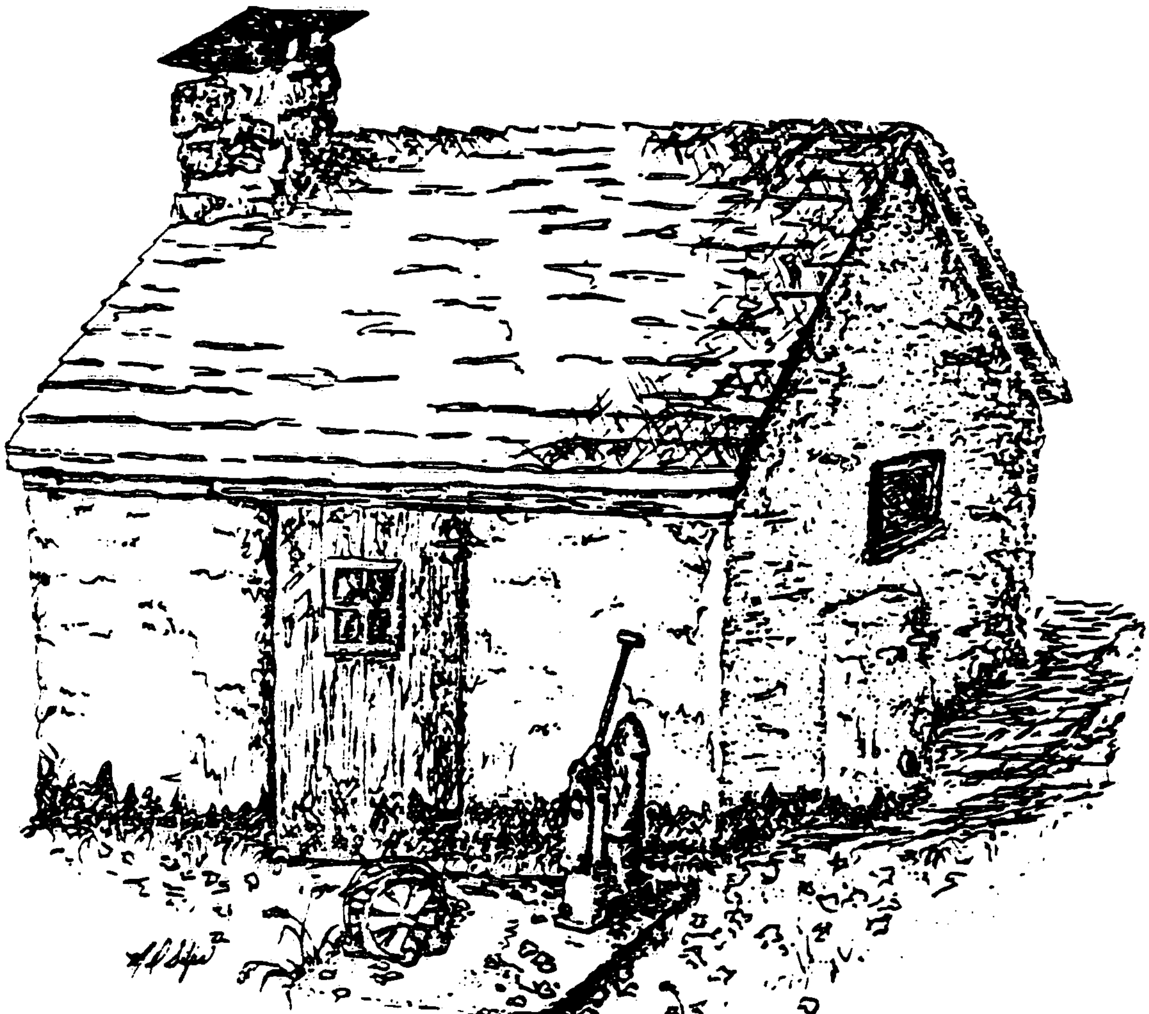
Owner's name and well number	Location		Average pumping rate, in ft^3/s							Aquifer
	Row	Column	1900-29	1930-45	1946-52	1953-59	1960-65	1966-68	1969-71	
Madison Water Dept., Well A, No. 1-12	45	26	0.20 *	0.50 *	0.67**	0.50**	0.37	0.48	0.57	Valley fill, Chatham Valley
Madison Water Dept., Well E	45	27							.41	Valley fill, Chatham Valley
Chatham Borough, Nos. 1, 2, 3	46	30	.30 *	.60 *	.80 *	1.00 *	1.23	1.48	1.51	Valley fill, Chatham Valley

* Estimated
** Pumpage at this node has not been reported. Value given is estimated from total pumpage for several nodes.

Location of wells shown in plate 1.

REFERENCE NO. 11

THE BURIED VALLEY AQUIFER SYSTEMS: RESOURCES AND CONTAMINATION



Early 19th Century Spring House

PASSAIC RIVER COALITION

246 Madisonville Road

Basking Ridge, New Jersey 07920

(201) 766-7550

1986

THE BURIED VALLEY AQUIFER SYSTEMS:

RESOURCES AND CONTAMINATION

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Basking Ridge, New Jersey 07920
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1986

Project Director: Daniel J. Van Abs, Ph.D.

Cover Design: Maureen D. Silfer

Cover Layout: Robert T. Pavlowsky

CHAPTER I

INTRODUCTION

The Buried Valley Aquifer Systems Region

Nearly one-half of New Jersey's residents rely on ground water for potable water supplies. The major aquifers of New Jersey are the Coastal Plains aquifers used by the shore communities, the Potomac-Raritan-Magothy aquifer used by Delaware River communities in southern New Jersey, and the buried valley (or valley-fill) aquifers of glaciated areas in northern New Jersey. The Buried Valley Aquifer Systems region is included within the last category.

In terms of political boundaries (see Figure G-1), the Buried Valley Aquifer Systems region encompasses the western parts of Essex and Union Counties, northern Somerset County and north, central and eastern parts of Morris County. Hydrologically, the region includes the Central and Upper Passaic River Basin, the Whippany River watershed, the Rockaway River watershed, and the Upper Lamington River watershed. The Upper Lamington River is part of the Raritan River Basin while the remainder of the region is included within the Passaic River Basin. The aquifer underlying the Upper Lamington is directly connected with the aquifer of the Rockaway River watershed and so is included within the region.

The Buried Valley Aquifer Systems region is characterized by a network of former river valleys which were filled with glacial outwash material by the Wisconson glacier which covered much of northern New Jersey until some 11,000 years ago. The **buried valley aquifers** thus formed are often contiguous and hydraulically connected to aquifers in the fractured bedrock below. The buried valley aquifers are prolific regionally, supplying over 40 million gallons per day for potable use. The bedrock aquifers are locally prolific, especially dolomite formations in the west and some shale areas in the east.

The region includes two "sole source aquifers" designated by the United States Environmental Protection Agency. The Buried Valley Aquifer Systems of the Central Passaic River Basin was designated in 1980, while the Rockaway Valley Quaternary Aquifer was designated in 1984. Recent hydrogeologic studies clearly show that the two aquifer systems are in fact one, fully connected through a formerly unknown buried valley. Therefore, this report treats the two designated areas as one, called the **Buried Valley Aquifer Systems.**

Importance of Ground Water to the Region

Ground water has played an ever-increasing role in supplying the water needs of residents and businesses throughout the Passaic River Basin and, indeed, throughout New Jersey. Within the basin, the most productive and intensively used aquifers are the buried valley (or valley-fill) aquifers. The buried valley aquifers form an extensive network of narrow-channeled sand and gravel deposits through which large quantities of water flow. They are located in many parts of the Passaic River Basin which were affected by the latest glaciation (the Wisconsin) and are most heavily concentrated in northern and eastern Morris County and western Essex County. Public water purveyors began tapping the buried valley aquifers around the turn of the century. Now, the use of the aquifers has reached major proportions, supplying the majority of water used in a number of municipalities, and providing water for over one-half million people and scores of major industries.

The intensive use of the aquifers, coupled with their high potential for contamination and loss of recharge, led municipalities and citizen organizations to pursue local, state and federal methods for protecting the ground water resources of the area. At the same time, the compilation of existing information on the buried valley aquifers was begun for use by decision-makers throughout the region. This report is the result of the second phase of efforts to understand the characteristics of the aquifers, and ground water use and contamination, so that this knowledge might be applied toward improved management of the aquifer systems. The first phase concluded in 1983 with the publication of the _Hydrogeology of the Buried Valley Aquifer Systems_. This second report enlarges upon the first, makes use of new findings from research of the State and federal governments, updates information on ground water diversions, and provides a first-time overview of contamination incidents and issues within the region.

History of the Sole Source Designation

In 1974, Congress passed the Safe Drinking Water Act, which in part provided that:

> If the Administrator determines, on his own initiative or upon petition, that an area has an aquifer which is the sole or principal drinking water source for the area and which, if contaminated, would create a significant hazard to public health, he shall publish notice of the determination in the Federal Register. After the publication of any notice, no commitment for Federal financial assistance (through a grant, contract, loan guarantee, or otherwise), may be entered into for any project which the Administrator determines may contaminate such aquifer through a recharge zone so as to create a significant hazard to public health, but a commitment for Federal financial assistance may, if authorized under another provision of law, be entered into to plan or design the project to assure that it will not so contaminate the aquifer. (Section 1424 (e))

In 1978 the Borough of Chatham, through its Borough Engineer and Environmental Commission, requested the Northeast New Jersey Policy Advisory Committee (PAC) for Water Quality Management to pursue the concept of sole source aquifer designation. The PAC served as a citizen advisory body for planning which included the Passaic River Basin. Following research by the PAC and the Passaic River Coalition on the background data and boundaries for the Buried Valley Aquifers, the City of East Orange and the Passaic River Coalition petitioned the U.S. Environmental Protection Agency's Administrator, Douglas Costle, on 16 January 1979 to designate the 80-square mile "Buried Valley Aquifer Systems" as a sole source aquifer (Appendix A, Exhibit 1; Appendix B, Exhibit 1). Under Section 1424 (e) regulations, the aquifer must supply at least fifty per cent of an area's residents. The Buried Valley Aquifer System supplies nearly ninety percent of the water used by residents of thirty-one municipalities, serving a population in excess of 580,000. Signing the petition were Mayor Thomas H. Cooke, Jr., of East Orange (Chairman of the PAC) and Ella F. Filippone, Executive Administrator of the Passaic River Coalition (Vice Chairman of the PAC).

The United State Environmental Protection Agency (EPA), Pegion II, held a hearing on 23 May 1979 in Roseland (Appendix A, Exhibit 2) to solicit public comments on the petition. The petition received strong support from the N.J. Department of Environmental Protection (NJDEP), numerous public officials, environmental organizations and citizens, both in letters of support and in testimony to EPA (Table I-1). EPA proposed an approach to the delineation of the area and to regulations which would implement the EPA review process over Federal programs which might adversely affect the aquifer. The most important proposed change added a "streamflow source zone" to the aquifer designation, so as to provide further protection for the aquifer by prohibiting pollution of ground water or surface water in the streamflow source zone by federal projects which might eventually pollute the aquifer. Table I-2 is a listing of municipalities covered (See also Figure G-1).

The EPA adopted the designation of the Buried Valley Aquifer Systems, including the streamflow source zone, by notice in the Federal Register on 8 May 1980 (Appendix B, Exhibit 2, Appendix A, Exhibit 3). The success of this joint municipal-citizen petition had also led to the formation of an intermunicipal Passaic Valley Ground Water Protection Committee (PVGWPC) in December 1979. The PVGWPC selected a primary goal of educating the general public as well as elected and appointed officials about the sole source aquifer designation, while encouraging municipal guidelines for development not covered by federal review.

The Committee outlined five goals for its programs:

1) Development of an education program to be presented to the Planning Boards of the region so that they consider ground water in their site plan reviews;

2) A study to identify the recharge areas for the aquifer;

3) A service to the Planning and Zoning Boards which would aid them in site plan review as it affects ground water and provide assistance for Master Plan revision;

4) A funding mechanism for setting aside lands critical to the protection of aquifer quality or recharge;

5) Respond collectively to issue of common interest.

During its first year of operation the Committee reviewed development projects with potential impacts on the aquifer, supported municipalities in the protection of their ground water resources, interacted extensively with state and federal officials and prepared educational information on the Buried Valley Aquifer Systems (Appendix A, Exhibit 5). The Committee completed five years of operations in 1985 with a public meeting on the benefits of intermunicipal cooperation for the protection of regional ground water supplies. Municipal support has consistently increased along with the sophistication of Committee operations and its influence on ground water management in the region.

In 1986, the Committee won a seminal victory with approval by the New Jersey Legislature of an act to regulate underground storage tanks statewide, capping five years of effort by the Committee on this issue. The PVGWPC had developed a model municipal ordinance for the control of toxic and hazardous materials, with a special focus upon the underground storage of such materials. Municipalities began consideration of local ordinances, leading to business support for uniform, statewide provisions and the ultimately successful campaign by the Committee (begun in 1984) for strong state legislation.

The Passaic Valley Ground Water Protection Committee, working with the Passaic River Coalition, determined to analyze and synthesize the existing hydrogeologic data on the Buried Valley Aquifer System for use by public and private decision-makers throughout the designated area. The information will serve as a basis for the eventual development of an aquifer protection plan for the region predicated upon municipal action in cooperation with existing State authorities.

The Rockaway Valley Quaternary Aquifer was designated a sole source aquifer in January of 1984, having been petitioned for designation in 1979 by the Upper Rockaway River Watershed Association. The designated area includes essentially the same area as the Rockaway River portion of the "streamflow source zone" from the Buried Valley Aquifer Systems designation, but adds the Upper Lamington River watershed in recognition of new evidence linking the two buried valley aquifers (see Table I-3 for a listing of municipalities). As the Passaic Valley Ground Water Protection Committee had already included the region within its area of concern, efforts to involve municipalities from the newly designated area continued. By 1986, the municipalities of Rockaway Borough, Rockaway Township, Randolph Township and Denville Township were members of the Committee in some capacity. The municipalities listed in Table I-4 have been members or associate members of the PVGWPC at some time from 1980 to 1986.

The Passaic River Coalition and the Township of West Milford co-signed a petition to the U.S. EPA in 1985 requesting the designation of the aquifers within the Wanaque River, Pequannock River and Pochuck Creek Watersheds as a "sole source aquifer." Both public and private water supplies in that region rely very heavily upon ground water from small buried valleys and glacial outwash deposits which are very prone to contamination. The region includes municipalities in both New Jersey and New York, in the northwestern portion of the Passaic River Basin generally (Figure I-1; Table I-5).

CHAPTER II

GEOLOGY OF THE STUDY AREA

Importance of Geology to Ground Water Resources

Geology is the study of an area's surface and subsurface rocks and sediments, the relative age of the formations, the method of deposition and transformation over time of these deposits, and the variation of the rocks and sediments over an area, both vertically and horizontally.

The layering of rocks and sediments in a vertical column, starting from the earth's surface, is called the **lithology** of that column. The description of how the lithology varies over an area is called **stratigraphy**. In some areas the lithology is fairly uniform, such as in New Jersey's coastal plains where there are alternating, flat beds of sand and clay. In other areas, such as northern New Jersey, the geologic formations have a complex stratigraphy, with a lithology that varies widely over short distances. Complex stratigraphies may arise due to folding, faulting, erosion, glaciation and other geological processes.

Until the geology of an area is known in some detail, the exploitation and management of ground water resources is at best a haphazard business. The more complex the stratigraphy, the more dependence is placed on detailed geologic information for knowledge of ground water resources.

The geology of an area determines the most important physical factors controlling whether ground water is a significant resource. Once the general nature of an area's geology is known, more specific information on the age, type and structure of the rocks and surficial deposits is needed to predict the existence, magnitude and characteristics of ground water resources. These factors determine the amount of water able to infiltrate the soil and percolate to the water table, the amount of water that aquifers can store and the rate at which water can be pumped from aquifers, the natural quality of ground water, and the ease with which pollutants can enter and move with the ground water.

Geologic Time Scale

Geologic history of the earth is divided into two categories, as shown in Table II-1. The four major divisions--Precambrian, Paleozoic, Mesozoic, and Cenozoic--are called eras, indicating the increasing complexity of living organisms that evolved during them. The division of eras into periods indicates changing environmental conditions. Geologic time is measured in two fundamentally different ways. The first is relative age in which the rock layer or a fossil is determined to be older or younger than another but no actual age is given. The second is absolute age in which rock, fossil or human artifact is dated using radioactive isotopes. As radioactive substances decay at a constant rate, the amount of radioactive substance remaining today relative to the isotope into which it has decayed can give a fairly good idea of the time when the material was created (Keller, 1979).

General Geology of the Study Area

The study area lies in north-central New Jersey (Figure G-1), in parts of Morris, Union, Essex, and Somerset Counties. The bedrock formations generally trend in a southwest-northeast direction. Bedrock and surficial formations range in age from Precambrian to Cenozoic, increasing in age generally with depth from the surface and as one moves to the northwest. The different ages and erosiveness of the bedrock formations have resulted in several different types of surface topography. These are grouped as physiographic provinces, of which five are recognized in New Jersey (Figure II-1). This study is primarily concerned with the Highlands and Piedmont Provinces. The Rockaway Valley Quaternary Aquifers are located in the Highlands Province, while the Buried Valley Aquifer Systems (as originally designated) are located primarily in the Piedmont Province, except for the streamflow source zone which is essentially the same as the Rockaway River watershed in the Highlands Province.

Over the years, geologic investigations have increased in sophistication. The extensive use of surface geophysics has provided considerable data about the area's geology through investigations at ground level. The earliest investigations relied upon outcroppings of bedrock and surficial deposits supplemented with information from road cuts and other investigations to make inferences about the subsurface geology.

TABLE II-1. Geologic Time Scale[a]

Million years ago	Era	Period	Events
1.5	Cenozoic	Quaternary	Ice Age in Pleistocene Epoch
65		Tertiary	
135	Mesozoic	Cretaceous	Deposition of sediments on Inner Coastal Plain
181		Jurassic	Upper Brunswick deposition; extrusion of Watchung basalt
220-230		Triassic	Erosion of Appalachian Mountains. Deposition of Brunswick Formation. Block faulting to form Newark Basin
280	Paleozoic	Permian	Climax of Appalachian Revolution; extensive folding and faulting
310		Pennsylvanian	
345		Mississippian	
405		Devonian	Acadian Orogeny: further uplift of Appalachian geosyncline
425		Silurian	
500		Ordivician	Taconic Orogeny: uplift of Appalachian geosyncline
570-600		Cambrian	Subsidence of Appalachian geosyncline continued
4,500[b]	Precambrian		Formation of Appalachian geosyncline. Ramapo fault originated at this time. Volcanic activity formed Eastern Uplands

[a]Table is not to scale.

[b]Recent estimate of the age of the earth. However, the estimated age has been increasing steadily as older rock formations are discovered.

Source: Keller, 1979; Kelland and Kelland, 1978

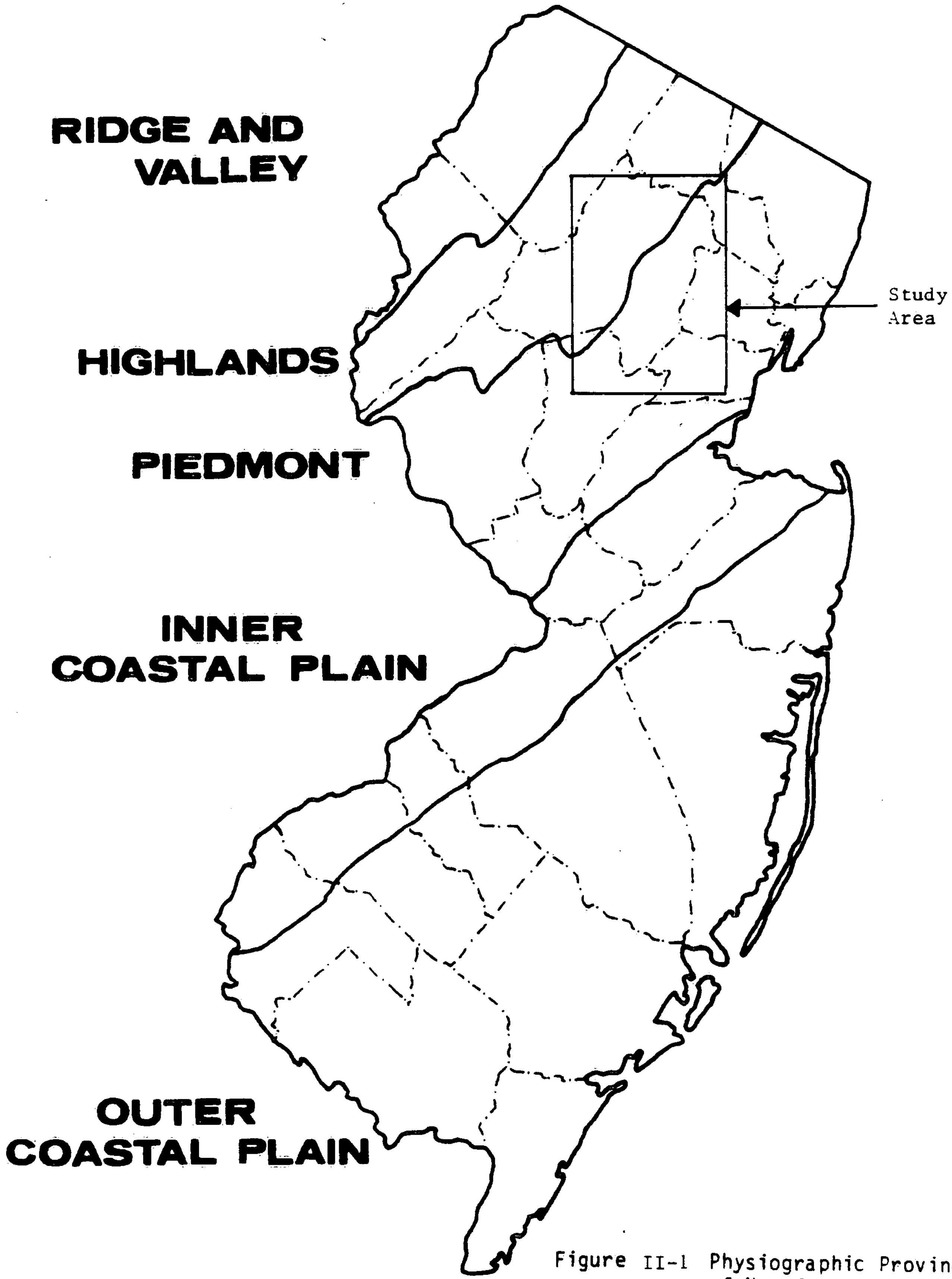


Figure II-1 Physiographic Provinces of New Jersey

Source: Kelland and Kelland, 1978

More recent and widespread use of formation logs from wells drilled deep into the ground has provided more extensive data on an area's lithology. Still, many gaps existed and still exist, as drilling gives point-by-point information without a definitive answer on the stratigraphy of the area between the wells.

This century has seen an increase in the application of physics theory to the study of geology, through a technology called geophysics. Geophysics has been used in the location of mineral fields, petroleum deposits, ground water resources and pollution plumes moving subsurface. Surface geophysical techniques, such as direct current-resistivity, electromagnetic and induced polarization, seismic reflection and refraction, gravimetry and magnetic methods, are often used in conjunction with drilling. Usually fewer observation holes are needed than if drilling was the sole technique used. The observation holes are used to verify or calibrate the data gathered through surface geophysics. Geophysics is a useful technique for geologic investigations as it can provide a more complete picture of the stratigraphy of an area and the potential existence of ground water resources than can drilling alone (Zohdy, et al., 1974).

Key Geologic Events in Northern New Jersey

Northern New Jersey, the location of the Buried Valley Aquifer Systems, has been marked by three major events: the creation and erosion of the Appalachian Mountains; the creation of the Newark Basin in the Piedmont Province; and the effects of several glaciation episodes across much of the study area. Each area's geologic history will be discussed, followed by a brief description of the aquifers.

The Ridge & Valley and Highlands Provinces

The geologic processes which occurred in New Jersey over the hundred of millions of years through the Precambrian and Paleozoic Eras produced a complex series of rock types. Sediments were deposited and compressed into rocks. The rocks were subsequently folded and faulted, intruded with volcanic materials, and metamorphosed by heat and pressure. The following rock types resulted: granite, gneiss, diorite, slate, marble, limestone, dolomite, siltstone, claystone, shale, and sandstone.

The distribution of Precambrian and Paleozoic rocks is limited to the northwestern section of New Jersey in the Ridge and Valley and the Highlands physiographic provinces (Figure II-1). Fenneman (1938), Kummell and Lewis (1940), and Wolfe (1977) provided detailed information on these areas. The study area includes some Precambrian formations along the western edge of the Upper Passaic and Whippany River watersheds and much of the Rockaway River watershed west of the Ramapo Fault, in the Highlands Province. Precambrian formations are poor aquifers.

The Paleozoic rocks also are generally poor aquifers, with the exception of the Kittatiny Formation (dolomitic limestone). The Kittatiny Limestones are located primarily within the long valley running from Picatinny Arsenal in Rockaway Township, southwest toward Chester Township. A connected valley (Flanders Valley) also contains dolomite which extends southwest parallel to the Upper Lamington valley.

Formation of the Piedmont Province

The Appalachian Mountains were uplifted at the end of the Paleozoic Era when the European and African plates collided with the North American plate.[1] Figure II-2 illustrates the assumed cross-section of New Jersey at that time. As the plates separated, faulting occurred along the eastern edge of the Highlands and the western edge of the Eastern Uplands creating a basin (Figure II-3). Eroded materials from these mountains were deposited into the basin and later became the rocks that occur in the area today.

The basin is called the Newark Basin and the rocks that formed in it are members of the Newark Group. The basin is part of the Piedmont physiographic province which extends in New Jersey from the Delaware River (from Trenton to north of Frenchtown), northeast to the New Jersey-New York line (from Mahwah to the Hudson River). The Piedmont totals approximately 20% of the area of New Jersey (Figure II-1). The Piedmont

[1] The concept of the continents and ocean basins being divided into six major plates and a number of minor ones floating atop the more plastic mantle has revolutionized modern geology. The collisions and breaking away of these plates has shed new light on the processes that form volcanos, earthquakes, faults, and mountains. From the pioneering work of Alfred Wegener (1915), a German meteorologist, a new branch of geology, "Plate Tectonics," has emerged and with it has come an explanation of the major crustal features of the earth.

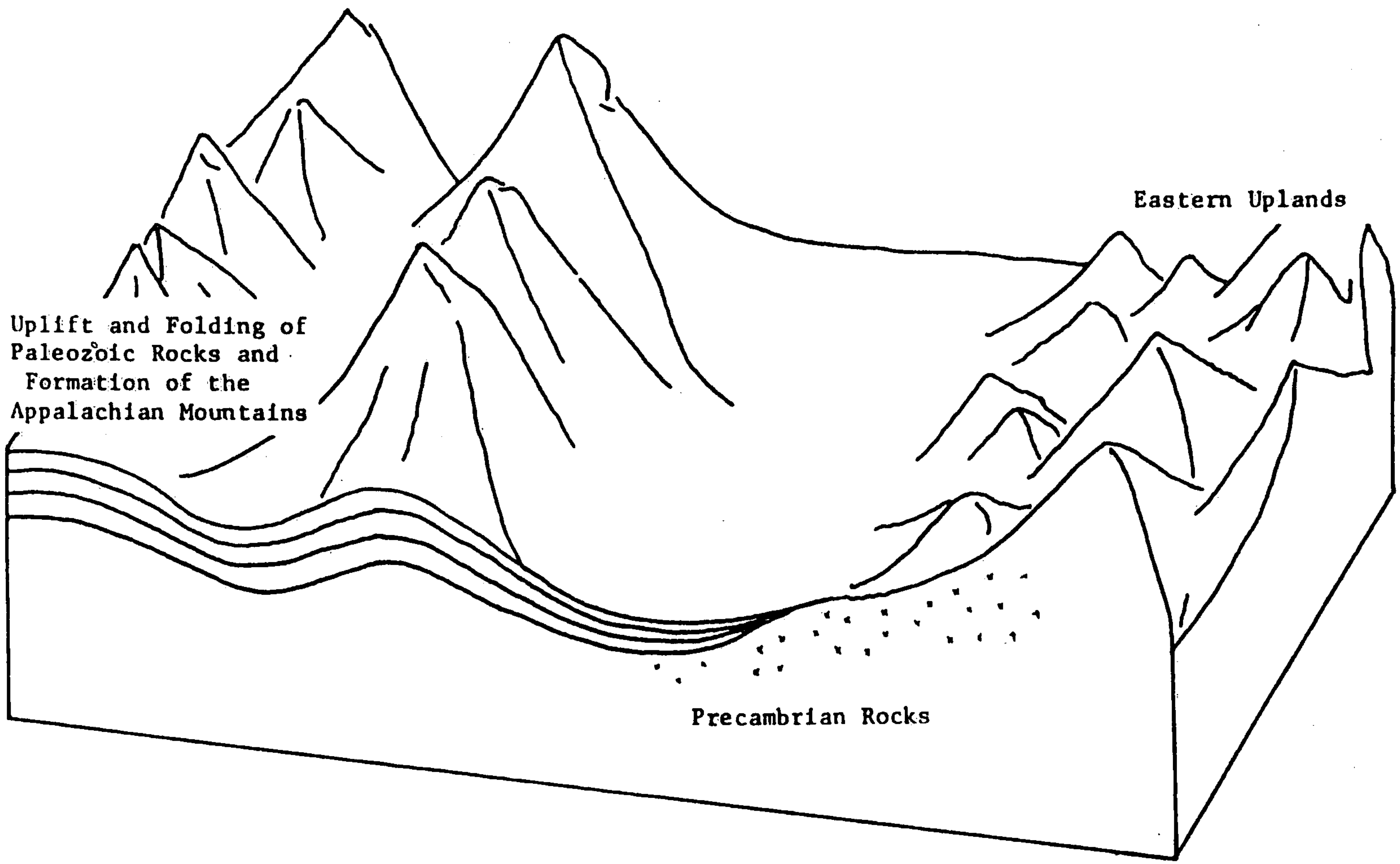


Figure II-2 Uplift of the Appalachian Mountains: Late Paleozoic.

Source: Passaic River Coalition, 1981.

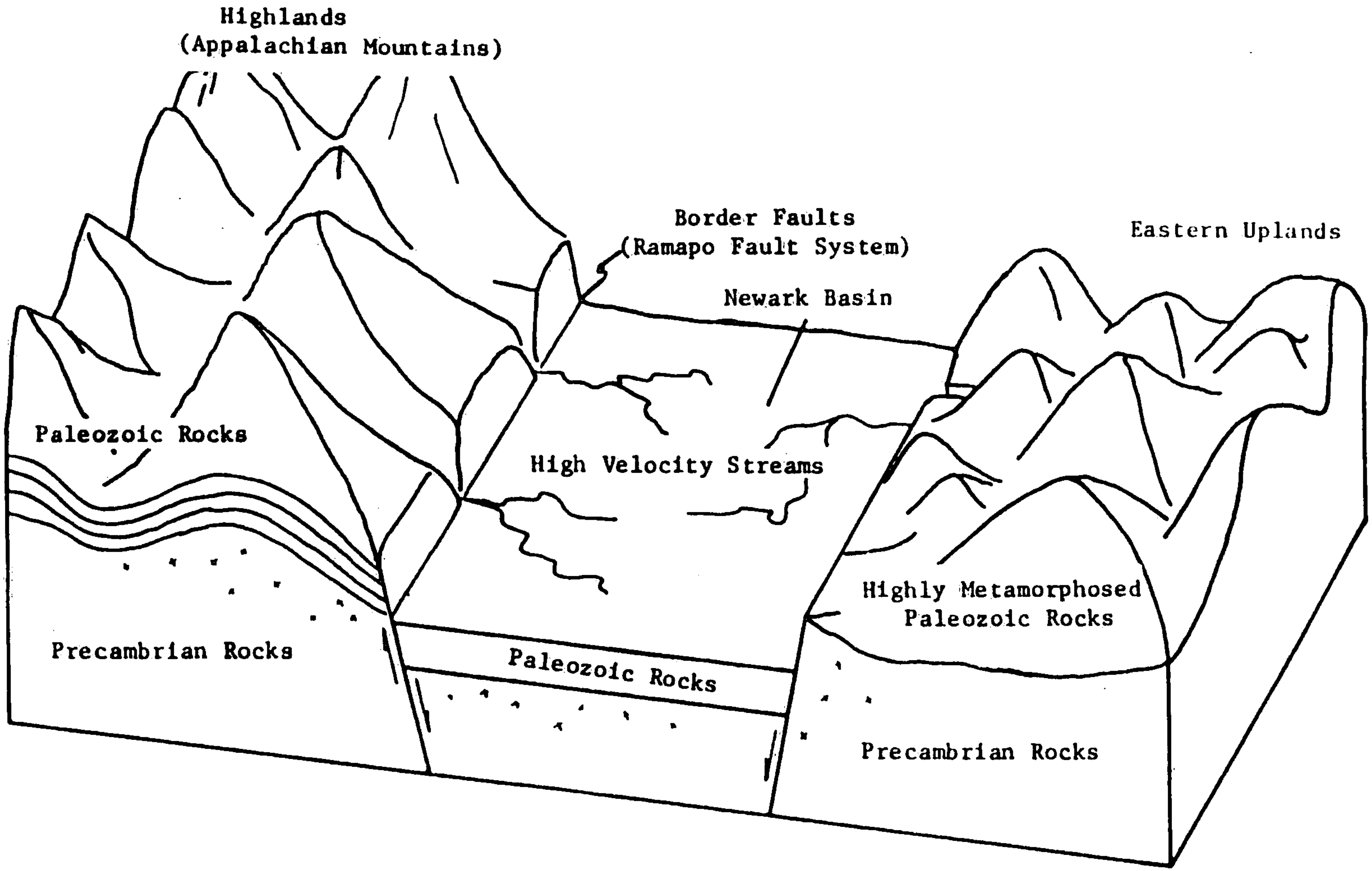


Figure II-3 Down-Faulting and Formation of the Newark Basin: Early Triassic.

Source: Passaic River Coalition, 1981.

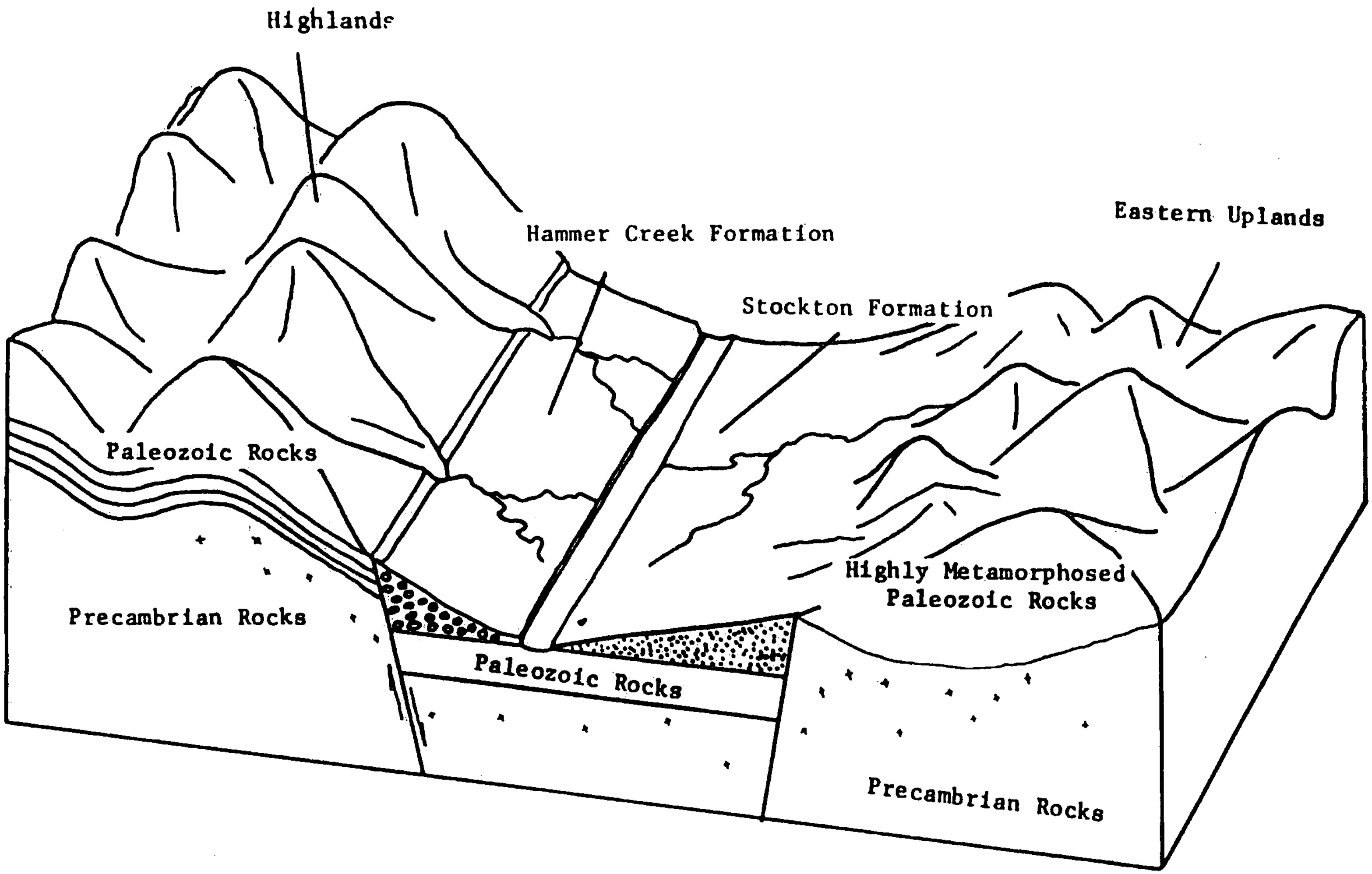


Figure II-4 Deposition of the Stockton and Hammer Creek Formations: Triassic

Source: Passaic River Coalition, 1981.

is characterized by gently rolling plains 200 to 400 feet in elevation underlain by easily eroded rocks, and several ridges underlain by resistant rocks (Wolfe, 1977).

According to Van Houten (1969), deposition in Triassic Period began with the transport of arkosic materials (poorly sorted feldspar and quartz particles) from the Eastern Uplands forming the Stockton Formation (locally called brownstone) to a depth of 6,000 feet. Coarse materials eroded from the Highlands formed the Hammer Creek Formation, a conglomerate rock approximately 1,000 feet thick (Figure II-4). A number of outcrops of the Hammer Creek Formation occur near the western edge of the Newark Basin.

Later in the Triassic Period deposition of these formations ended. A shallow lake formed in the Newark Basin (Figure II-5). An alternating series of sediments with rock fragments derived from existing rocks, and then chemical deposits from dissolved materials in the lake water, formed a clay-like rock approximately 3,700 feet thick called the Lockatong Formation. Outcrops of this formation occur at the eastern and western ends of the basin (Van Houten, 1969).

From late Triassic to early Jurassic time,[2] the Brunswick Formation was deposited in the Newark Basin, to a depth of 6,000 feet in the central portion and 16,000 feet in the northeast. Figure II-6 shows the meandering streams that transported and deposited muddy sediments eroded from the Highlands. The Brunswick is composed mainly of soft red shales, interbedded with sandstone and some conglomerate. The red color of the shale is from iron oxide in the form of the mineral hematite (Wolfe, 1977).

Volcanic activity occurred in the Newark Basin during the early Jurassic Period. Fissures formed in the earth's surface resulting in a flow of basalt. Deposition of the Brunswick Formation continued in the periods between the lava flows. Three separate periods of volcanic activity occurred, each with numerous individual flows. Later faulting caused the flows and Brunswick Formation to be tilted to the northwest (Figure II-7). After an extended period of erosion the basalt flows were exposed forming the Watchung Mountains.

[2] The Brunswick Formation was thought to be only of Triassic age until several studies had redated the upper 1,500 feet of the formation as well as the Watchung basalt flows and the Palisades sill to early Jurassic. (Cornet, Traverse and McDonald, 1973).

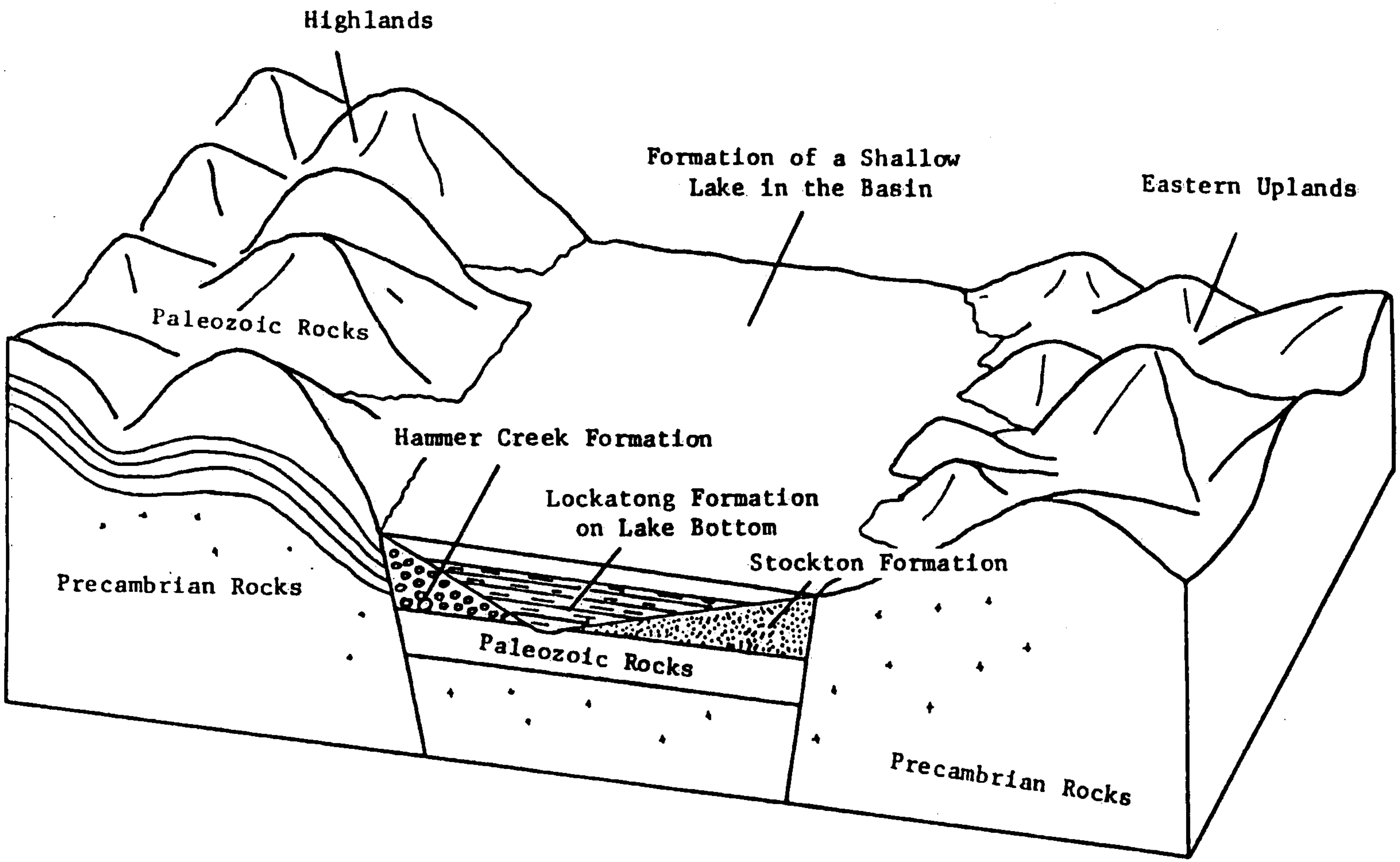


Figure II-5 Deposition of the Lockatong Formation: Triassic.

Source: Passaic River Coalition, 1981.

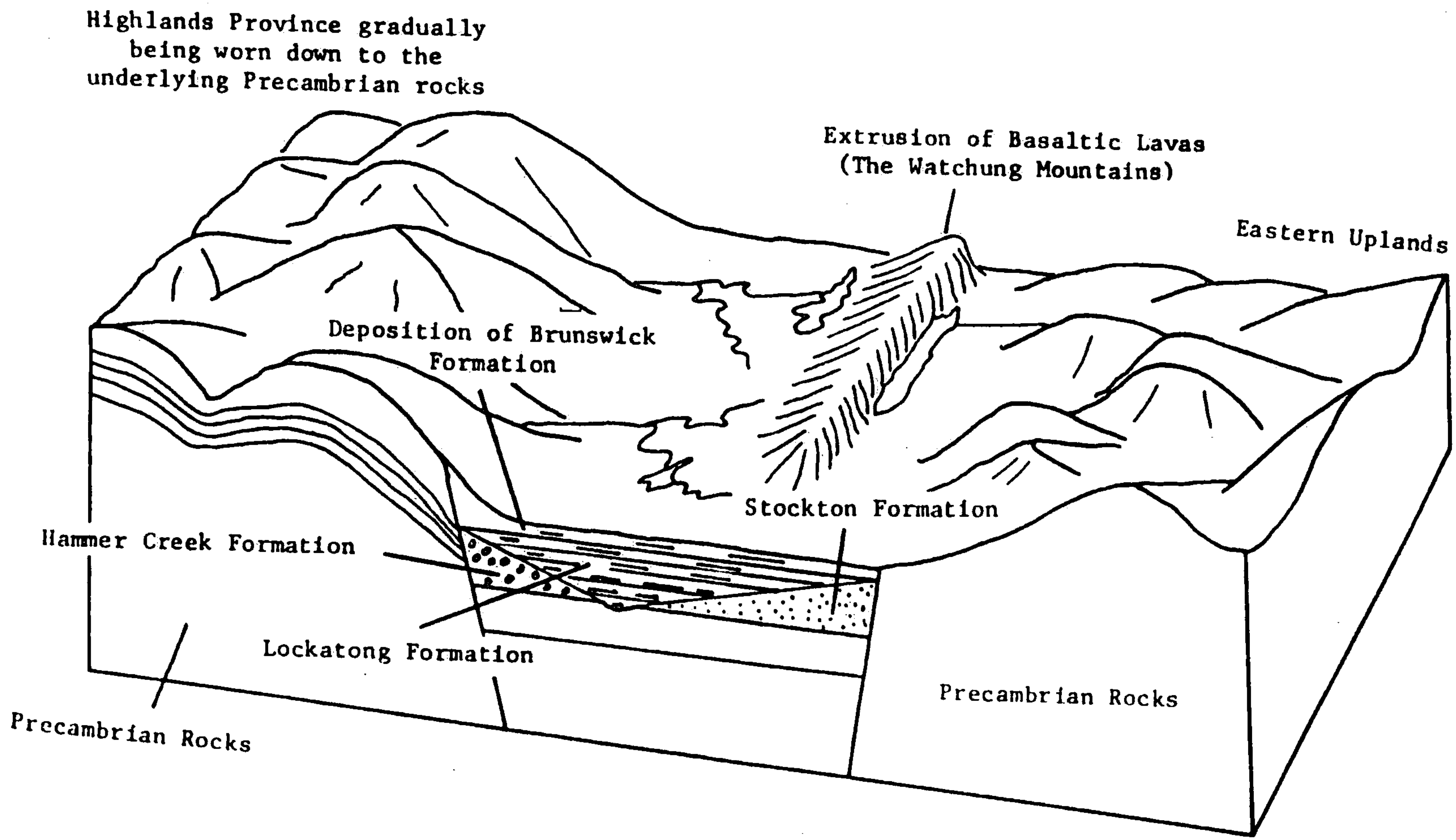


Figure II-6 Depositional Environment of the Brunswick Formation: Triassic-Jurassic.

Source: Passaic River Coalition, 1981.

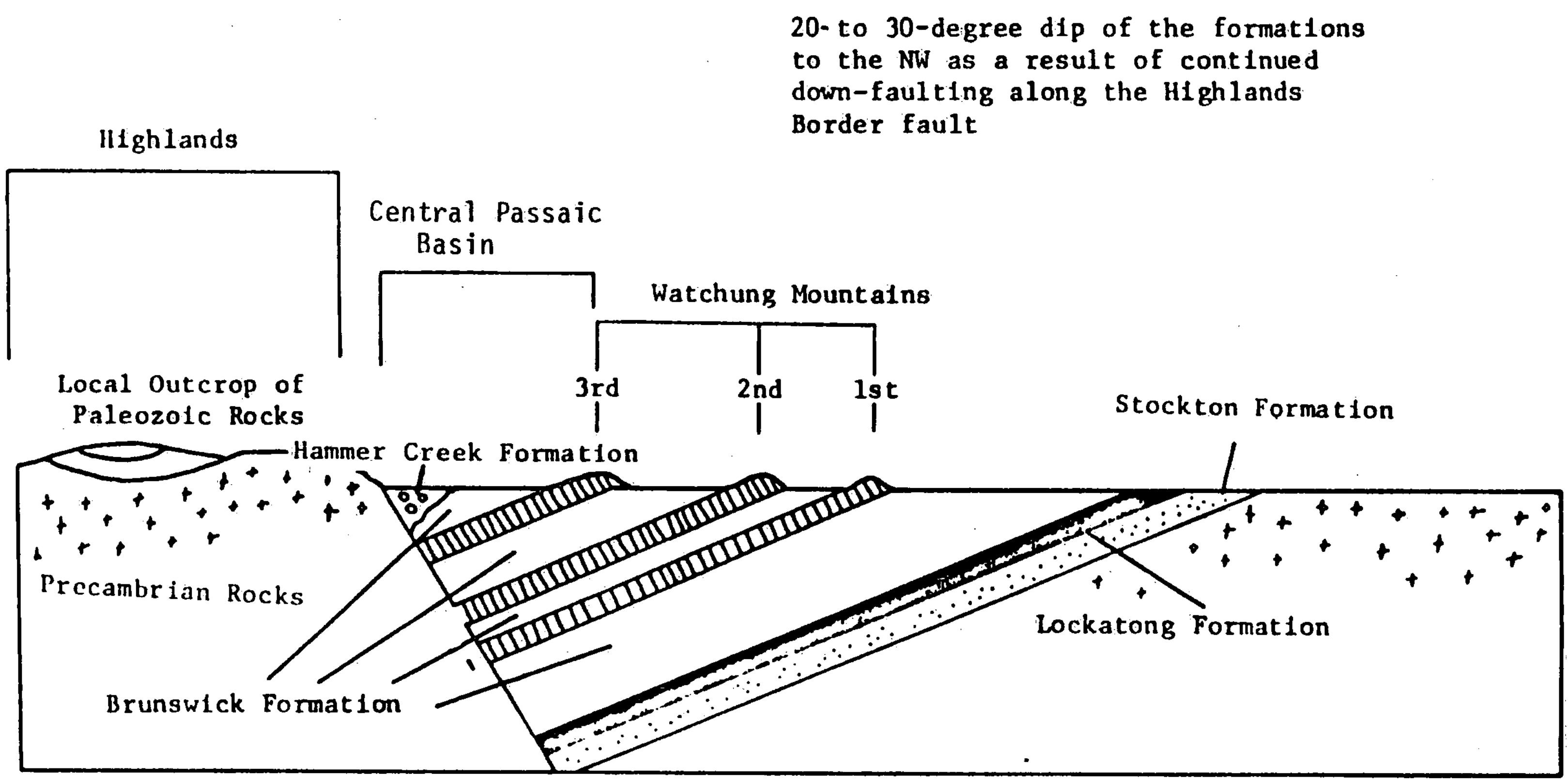


Figure II-7 Present-Day Cross-Section Through the Newark Basin.

Source: Passaic River Coalition, 1981.

The bedrock of the study area, therefore, is composed of Precambrian rocks occurring in the Highlands Province, the Hammer Creek Formation cropping out in a few places along the eastern edge of the Highlands, the Watchung Basalt forming three ridges called the Watchung Mountains, and the Brunswick Formation in the remainder of the area. The Stockton and Lockatong Formations are far below the earth's surface in this area and are of little significance to the region's ground water resources.

Glaciation

As important as the bedrock of the study area is to the region's ground water supplies, the results of glaciation in the Pleistocene Epoch (a division of the Quaternary Period, refer to Table II-1) are of greater significance. The latest Pleistocene glaciation began approximately 80,000 years ago. This ice advance, called the Wisconsin Glaciation, reached its maximum extent in New Jersey about 18,000 years ago and receded about 11,000 years ago (Wolfe, 1977). The maximum extent of this glaciation is marked by a terminal moraine, shown in Figure II-8, which extends from Perth Amboy through northern Middlesex County, the Union-Somerset County boundary, and across the center of Morris County, passing through the towns of Chatham, Madison and Morristown, and into the Rockaway River watershed.

The ice acted as a giant bulldozer pushing and carrying great quantities of soil and rock in, under, and on top of the ice. When melting along the front of the glacier halts its forward movement, these materials are deposited in a line at the face of the glacier in a **moraine**. Within a moraine, materials of all sizes are mixed together in deposits called **glacial till**. Moraines in the region consist both of the **terminal moraine** (a long ridge along the farthest advance of the glacier) and **ground moraines** (flat beds of glacial till deposited on the land surface). The melting water then carried some of the glacial materials and deposited the particles in a stratified manner. That is, the clays, silts, sands and gravels are separated in layers and over distance because of the capacity of moving water to carry fine materials farther than coarse ones. Many of the sand and gravel pits now mined for construction materials were created in this manner. In some areas, large amounts of stratified materials were deposited in preglacial channels and valleys. These sands and gravels constitute the buried valley aquifers on which much of the area depends for its water supply.

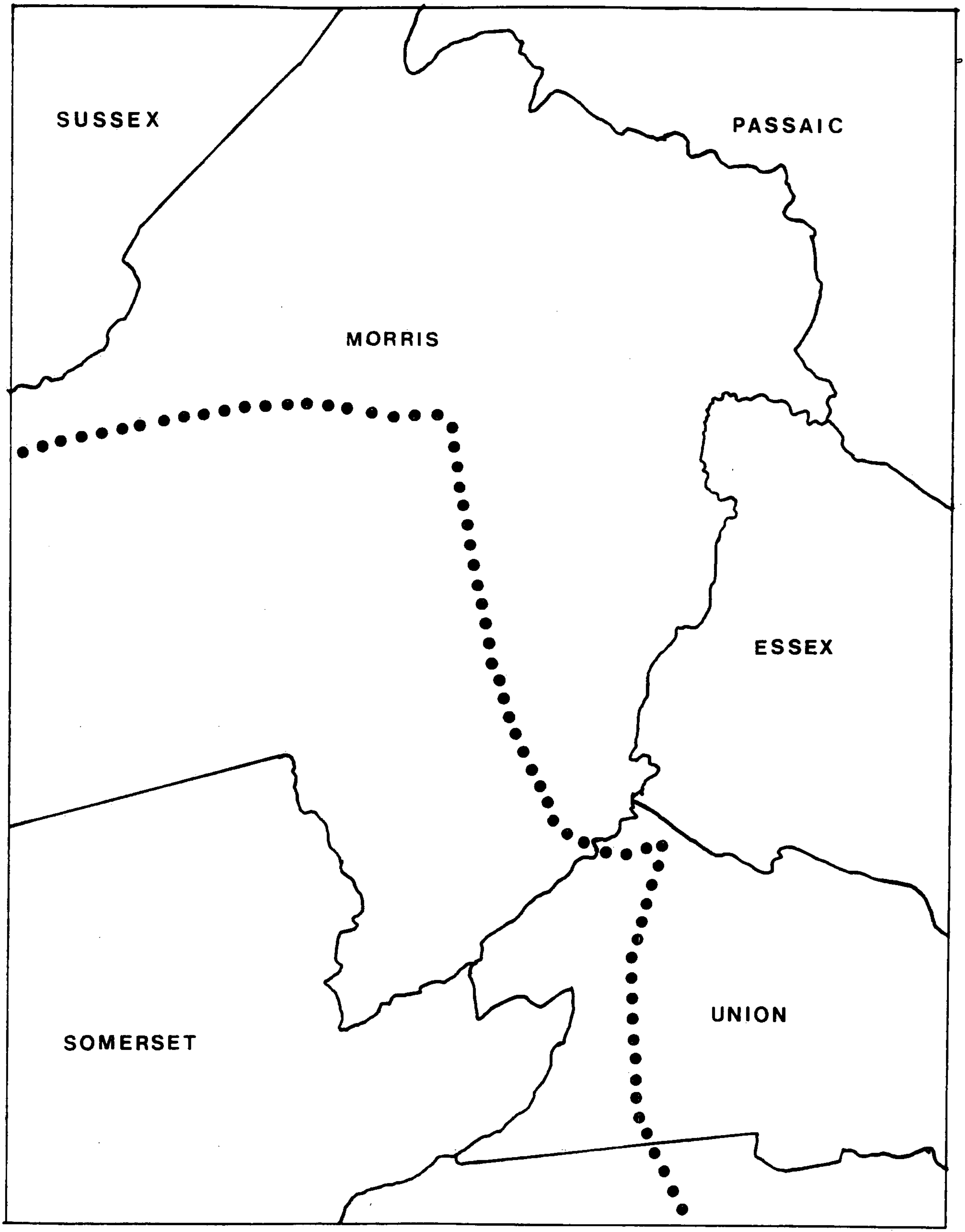


Figure II-8. Terminal Moraine of the Wisconsin Glaciation

Source: Wolfe, 1977.

Aquifers of the Study Area

Aquifers are geologic formations which have capability to store and transmit water which is recoverable in sufficient quantity to be economically usable (U.S. ACE-HEC, 1972). The capacity of an area's geologic formations to serve as aquifers is largely determined by two characteristics. First, the material must have space for water; that is, it must be **porous**. Second, water must be able to move freely through the material; that is, it must be **permeable**.

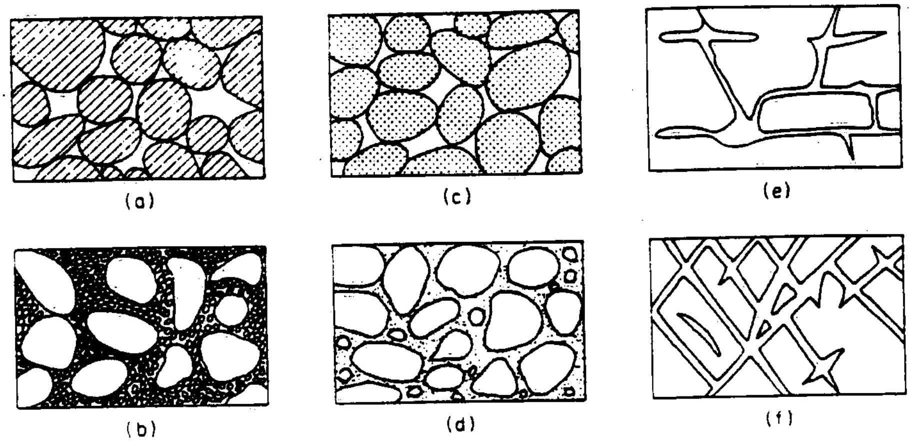
In consolidated rocks found in the study area - shale, sandstone, and basalt - both porosity and permeability are dependent on secondary fractures, joints, faults, and solution channels, because the rocks are basically not porous in their solid unbroken state. Sandstone usually is more productive as aquifers than other bedrocks because the cementing materials between the same grains may be absent in places or it may have been removed by solution.

Unconsolidated materials such as glacial deposits and alluvial deposits along streams usually make more productive aquifers than crystalline rocks. The best aquifers are composed of sands or gravels which have both high capacity for storing water and high permeability for transmitting it. Some sand and gravel deposits are not well sorted and have much of the space between the large grains filled with silt and clay. In such cases, their porosity and water-transmitting capacity are greatly reduced. Ways in which porosity may exist in rocks and sediments are illustrated in Figure II-9. Figure II-10 illustrates the basic aquifer types of the region.

An analysis of the water-bearing properties of the aquifers in the study area gives an indication of the amount of water a well will produce. A brief description of applicable characteristics of Precambrian rocks, carbonate rocks, Brunswick Formation, Watchung Basalt, and Pleistocene stratified deposits follows. A summary is shown in Table II-2.

Precambrian Rocks

The varied types of rock of Precambrian age serve as aquifers in the Highlands Province portion of Morris County, but none are located in Essex, Somerset or Union Counties. Nearly all ground water supplied from Precambrian rocks occurs in fractures, often close to the rock surface. Therefore, the amount of water available from these rocks depends on the size and number of the intersecting fractures. The yield



(a)- well-sorted aluvial material, high porosity;

(b)- poorly sorted alluvial material, low porosity;

(c)- well-sorted deposit of porous pebbles, very high porosity;

(d)- well-sorted deposit, porosity decreased by cementation;

(e)- rock rendered porous by solution;

(f)- rock rendered porous by fracturing.

Figure II-9 Types of Rock Interstices and Relation of Rock Texture to Porosity

Source: U.S. Army Corps of Engineers, Hydrologic Engineering Center, 1972 (from Meinzer, 1923).

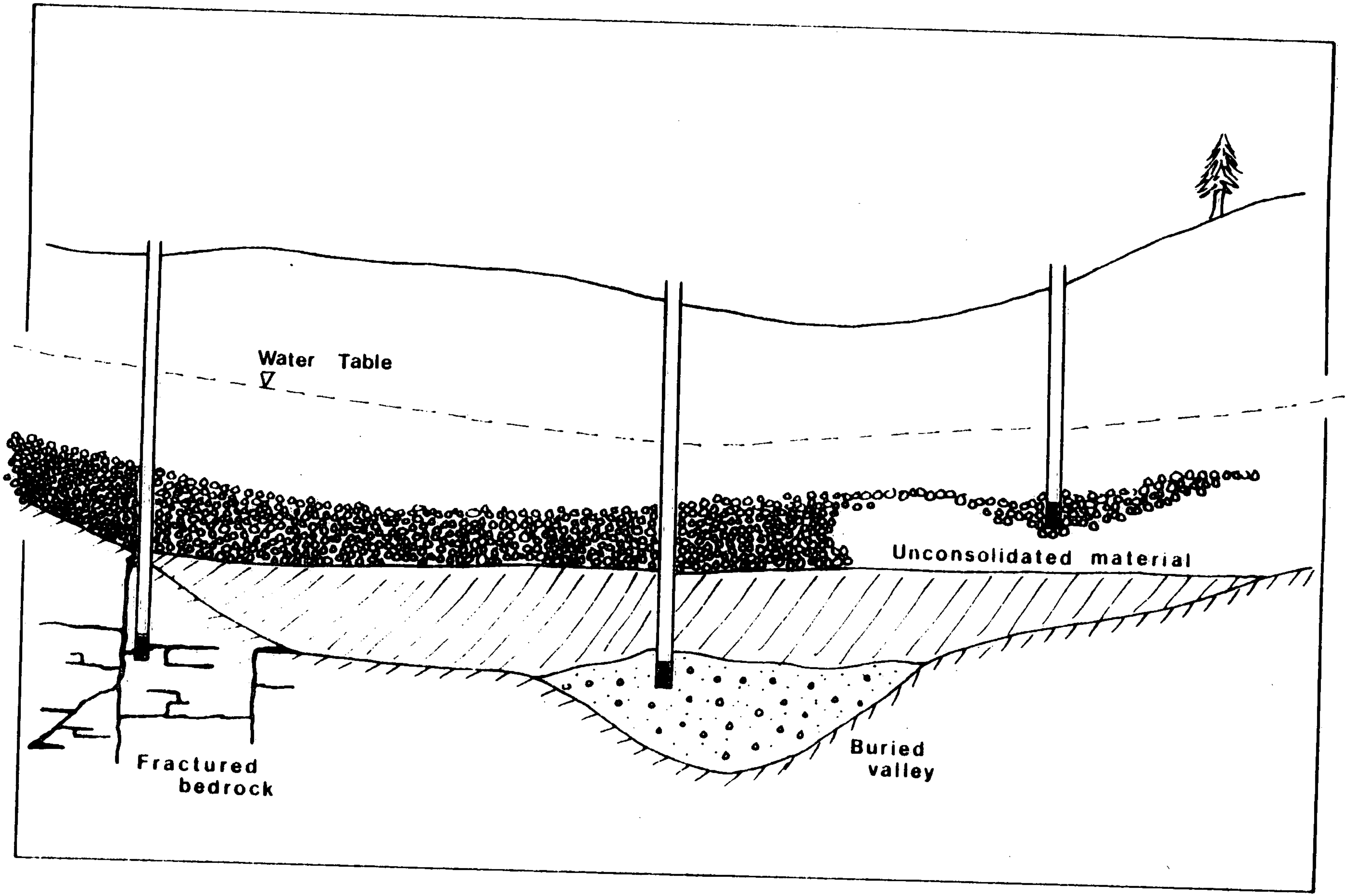


Figure II-10. Basic Types of Aquifers in Study Area

TABLE II-2

HYDROLOGIC DATA FOR AQUIFERS IN STUDY AREA

	Average	Range
Precamrian Rocks		
Yield of 79 large-diameter wells in Morris County	121 gpm	4 - 400 gpm
Coefficient of transmissivity of wells in Morris County	-	2,000 - 3,000 gpd/ft
Coefficient of storage a of wells in Morris County	-	0.001
Specific Capacity of 56 wells in Morris County	1.77 gpm/ft	0.06 - 15.1 gpm/ft
Watchung Basalt		
Yield of 5 wells in Morris County	-	30 - 53 gpm
Yield of 26 wells in Essex County	116 gpm	7 - 500 gpm
Specific capacity of wells in Morris County	1 gpm/ft	-
Specific capacity of wells	1.74 gpm/ft	0.05 - 5.66 gpm/ft
Brunswick Formation		
Yield of 37 large-diameter wells in Morris County	142 gpm	4 - 660 gpm
Yield of 35 large-diameter wells in Essex County	364 gpm	35 - 820 gpm
Coefficient of transmissivity of 7 wells in Morris County	-	7500 - 30,000 gpd/ft
Coefficient of storage of 7 wells in Morris County	0.00005	-
Specific capacity of 34 wells in Morris County	4.57 gpm/ft	0.03 - 33.33 gpm/ft
Specific capacity of 35 wells in Essex County	11.07 gpm/ft	0.21 - 70 gpm/ft

TABLE II-2 (Cont'd)

	Average	Range
	Pleistocene Stratified Aquifers	
Yield of 127 large-diameter wells in Morris County	502 gpm	20 - 2,200 gpm
Yield of 27 large-diameter wells in Essex County	908 gpm	410 - 1,593 gpm
Coefficient of transmissivity of 13 wells in Morris County	135,000 gpd/ft	-
Coefficient of storage of 13 wells in Morris County	0.00039	-
Specific capacity of 110 wells in Morris County	30.86 gpm/ft	0.24 - 500 gpm/ft

[a] Storage coefficient is the quantity of water released or taken into storage in a column of aquifer with unit cross-section and length equal to the thickness of the aquifer per unit change in hydraulic level (US Army Corps of Engineers, Hydrologic Engineering Center, 1972).

Source: Gill and Vecchioli, 1965; Nichols, 1968a.

of such rocks can vary considerably within a short distance, both horizontally and vertically. Because fractures are wider toward the surface due to weathering, a well in Precambrian rock is unlikely to supply much water below 300 feet. The 79 large-diameter public supply, industrial, and commercial wells in Precambrian rock that operated in 1965 throughout Morris County yielded an approximate average of 121 gallons per minute (gpm), and the maximum and minimum yields were 400 and 5 gpm respectively. The larger amounts are usually associated with fault zones (Gill and Vecchioli, 1965).

Water quality from Precambrian wells is generally good. Hardness ranges from soft (less than 50 ppm) to moderately hard (60-120 ppm); pH ranges from slightly acidic to slightly alkaline; and iron occurs in objectionable quantities in some areas (Gill and Vecchioli, 1965).

Carbonate Rocks

The primary carbonate rock aquifer in the study area is that of the Kittatiny Formation. This is a long, deep, narrow bed of dolomitic limestone from the Paleozoic Era. Gill and Vecchioli (1965) reported that the five major wells developed in the dolomite at the time had yields ranging from 40 to 380 gpm. They suggested that the Kittatiny Formation had the potential for moderate to large ground water supplies. The Alamatong well field has Well 5 with a yield of 500 gpm and the potential for greater yields, in the Lightsville Dolomite. Markewicz (personal communication, 1986) reports that other dolomite wells have yields of up to 3000 gpm in the Pequest Valley (Warren County). He estimates, based on the sketchy data available to date, that 10 to 15 mgd may be available from the various dolomite deposits.

Newark Group: Brunswick Formation

The Brunswick Formation serves as an aquifer in the following communities of the Buried Valley Aquifer Systems: Chatham Borough, East Hanover Township, Florham Park Borough, Hanover Township, Harding Township, Lincoln Park Borough, Montville Township, Morris Township, Town of Morristown, Parsippany-Troy Hills Township, and Passaic Township in Morris County; Caldwell Borough, Fairfield Township, Livingston Township, Millburn Township, North Caldwell Borough, Roseland Borough, West Caldwell Borough, and West Orange Town in Essex County; Bernards Township, Bernardsville Borough and Warren Township in Somerset County;

and Berkeley Heights Township, New Providence Borough, Summit City in Union County (Gill and Vecchioli, 1965; Nichols, 1968a; Nemickas, 1976).

The approximately 6,000 feet-thick Brunswick Formation is composed of shale with local occurrences of sandy and pebbly consolidated beds. The sandstone ranges from a few inches to 20 feet in thickness. The many joints and fractures in the rock allow for retention and transport of a fairly large volume of ground water. Wells yield from 4 to 650 gpm in Morris County, from 35 to 820 gpm in Essex County, and from 12 to 870 gpm in Union County (Gill and Vecchioli, 1965; Nichols, 1968a; Nemikas, 1976). Wells of greatest yield are usually those between 200 and 500 feet deep where several source zones feed the well, and is usually hard.

Newark Group: Watchung Basalt

The Basalt Formation serves as an aquifer in the following communities within the study area: Florham Park Borough, Lincoln Park Borough, and Montville Township in Morris County; Essex Fells Township, Fairfield Township, Livingston Township, Millburn Township, North Caldwell Borough, West Caldwell Borough, and West Orange Town in Essex County; Warren Township in Somerset County; and Berkeley Heights Township, New Providence Borough, and Summit City in Union County (Gill and Vecchioli, 1965; Nichols, 1968a; Nemikas, 1976). The basaltic flows of the Watchung Mountains serve as a small source of ground water in the study area. Water is usually concentrated in gas-created vesicles and fractures in the rock. Wells yield volumes of 30 to 53 gpm from depths of less than 300 feet in Morris County (Gill and Vecchioli, 1965); from 7 to 400 gpm in Essex County (Nichols, 1968a); and from 20 to 164 gpm in Union County (Nemikas, 1976). Water from the Watchung rocks is usually hard, ranging from 60 to more than 180 gpm. Some wells also have high sulfate, iron and manganese levels (Gill and Vecchioli, 1965).

Pleistocene Deposits

The Pleistocene glacial deposits serve as aquifers in the following study area communities; Chatham Borough, Denville Township, Dover Town, East Hanover Township, Florham Park Borough, Hanover Township, Madison Borough, Montville Township, Morris Township, Morris Plains Borough, Mountain Lakes, Parsippany-Troy Hills Township, Rockaway Borough, Rockaway Township, Roxbury Township and Wharton Borough in Morris County; and Essex Fells Borough, Fairfield Borough, Livingston Township, Millburn Township, and West Orange Town in Essex County (NJDEP, 1985).

The stratified deposits produce the largest source of ground water in both Morris and Essex Counties (77 per cent and 81 per cent). Wells yield from 20 to 2,200 gpm and the water is of good quality. This ground water is pumped from the buried valley (valley-fill) aquifers. The valleys existed before the Pleistocene glaciation. In some areas, coarse-grained sands and gravels were washed into the valleys by melting water from the glaciers. Later some of these deposits were overlain by glacial till, by lake sediments or both. Therefore, the location of the buried valleys is difficult to ascertain by direct observation from the surface. Figure II-11 shows the assumed origin of the buried valleys.

The primary ground water resources for the Buried Valley Aquifer Systems are contained in the Brunswick Formation of eastern Morris and Western Essex Counties (shale and sandstone), the carbonate rocks of western Morris County (dolomitic limestone) and the Pleistocene deposits of the entire study area. By far the dominant producers are the buried valley aquifers for which the region is named. Chapter III presents a basic understanding of the field of hydrogeology which serves as a foundation for discussion of the buried valley aquifers in Chapter IV and of the utilization of all aquifers within the region in Chapter V.

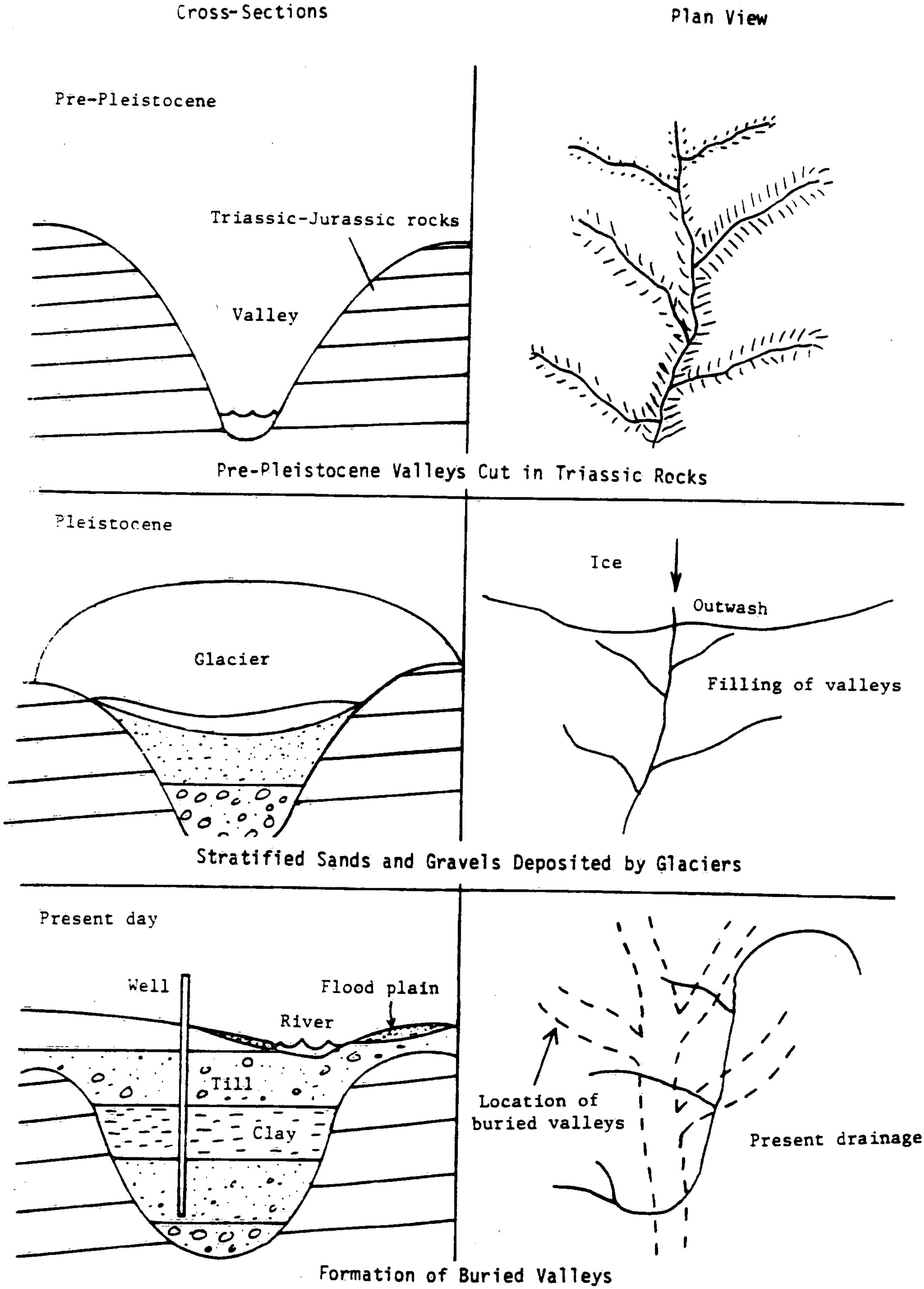


Figure II-11 Origin of the Buried Valley Aquifers
Source: Passaic River Coalition, 1981.

CHAPTER IV

DELINEATION AND DESCRIPTION OF THE BURIED VALLEY AQUIFERS

Introduction

This chapter presents the information currently available on the delineation of buried valleys and buried valley aquifers in the region. Although many research reports have been prepared, much of the detailed information necessary for informed management is lacking. Even such basic steps as the complete delineation of the aquifers have not been completed. An overview of the hydrogeological investigations performed to date is presented for a sense of the progress made over the years. The buried valleys are then described in some detail, by subregion. Finally, the hydrologic characteristics of the aquifers are discussed. Chapter VIII presents information on current and planned research which is focused on the Buried Valley Aquifer Systems.

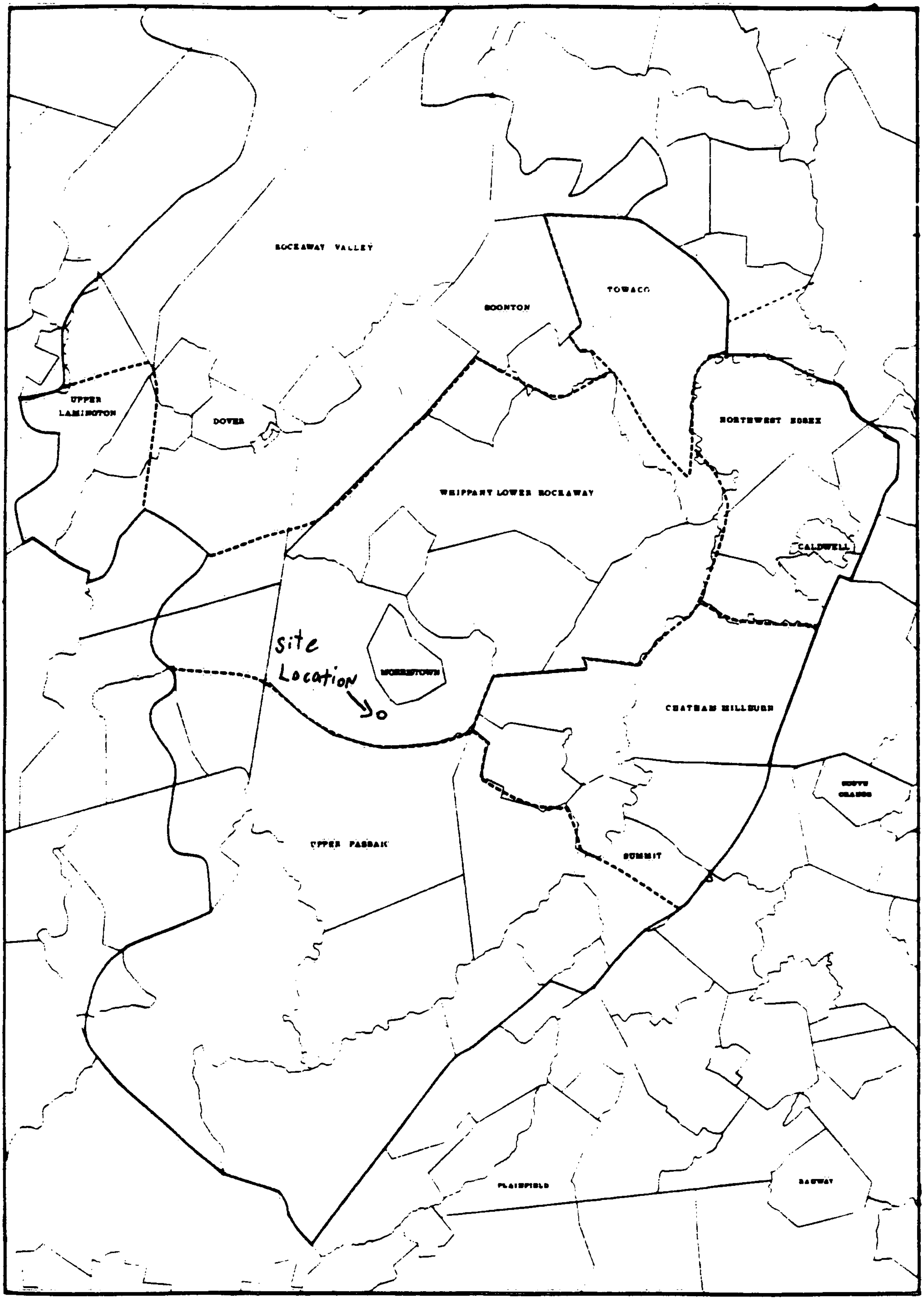
Subregions of the Aquifer Systems

Although evidence mounts that the entire valley-fill aquifer system of the Rockaway, Whippany and Passaic River watersheds are directly connected and therefore a single hydrologic system, a system of subregions is proposed for the purpose of focusing discussion (See Figure IV-1). The subregions of the Buried Valley Aquifer Systems are:

1) Rockaway Valley Aquifers--The entire Rockaway watershed upstream of the Jersey City Reservoir in Parsippany is considered as one system. From upstream to downstream, the municipalities of Jefferson, Rockaway Township, Wharton, Dover, Mine Hill, Roxbury, Randolph, Victory Gardens, Rockaway Borough, Denville, Boonton Town and Boonton Township are located within this subregion in part or in whole.

THE BURIED VALLEY AQUIFER SYSTEMS

FIGURE IV-1. SUBREGIONS OF THE STUDY AREA



2) Upper Lamington Aquifers--The Upper Lamington (or Black) River watershed includes aquifers tapped by the Morris County Municipal Utilities Authority and the Roxbury Water Company, in the municipalities of Mine Hill, Roxbury, Randolph and Chester Township. This subregion is considered separately from the Rockaway, though the aquifers are connected to the Rockaway system to the north.

3) Towaco Aquifer--The Towaco Buried Valley in Montville Township does not connect with the buried valley aquifers to the west, but may connect to the buried valleys of the Northwest Essex Subregion by way of the east through Lincoln Park, Wayne and Fairfield. The Towaco is considered as a separate subregion.

4) Northwest Essex Aquifers--The broad valley-fill sediments of Fairfield and the upgradient aquifers of the Caldwells, Essex Fells and Roseland comprise this subregion. The remaining municipalities of West Essex are included within the Chatham/Millburn Aquifers Subregion.

5) Whippany/Lower Rockaway Aquifers--The aquifer underlying the lower Rockaway River between Parsippany and Montville is apparently not connected to the upper Rockaway system, but rather connects to the south with deposits underlying the Whippany River watershed. Parsippany-Troy Hills is almost entirely within the Whippany watershed, as are Morristown, Morris Plains, Morris Township, Hanover, and western East Hanover. The Rockaway Valley subregion is apparently continuous with the major buried valley which traverses the Troy Brook watershed of Parsippany, but Parsippany is considered separately from the Rockaway Valley.

6) Chatham/Millburn Aquifers--This subregion with the longest history and greatest intensity of use is located just north of the terminal moraine in east-central Morris County and nearby portions of Essex County. The municipalities of Madison, Chatham Borough, Florham Park, Summit, Millburn, Livingston and eastern East Hanover comprise the subregion. The Chatham, Southern Millburn, Northern Millburn, Canoe Brook and Slough Brook Buried Valley Aquifers are within the area.

7) Upper Passaic--There are no major buried valley aquifers known in the Upper Passaic, located upstream (south) of the terminal moraine in Chatham Township, Passaic Township, Harding, Summit, Berkeley Heights, New Providence, Warren Township, Bernards Township, and portions of Mendham and Bernardsville. The subregion relies on ground water from shale and precambrian rocks, and contributes significantly to the base flow of the Passaic River.

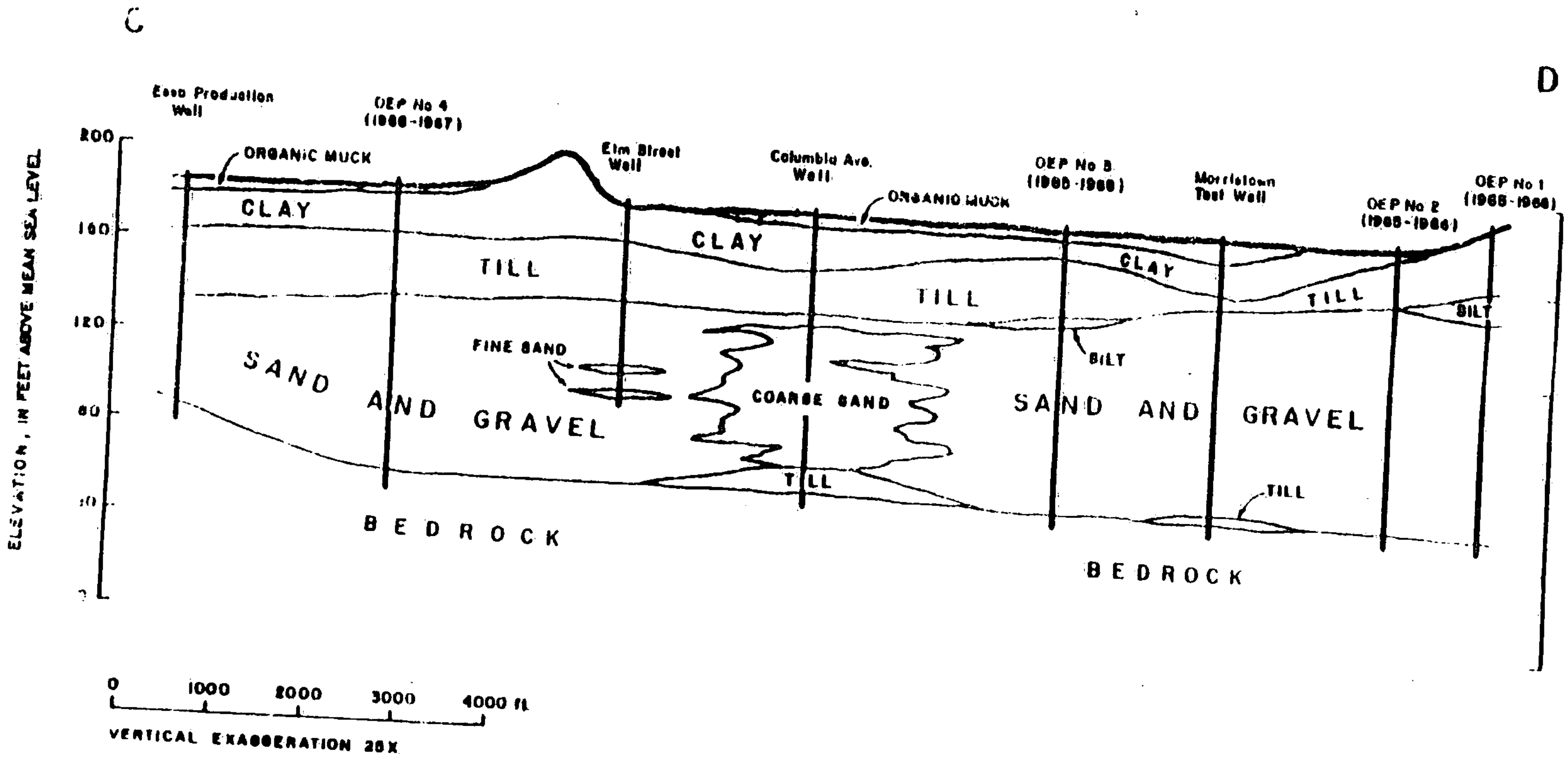


Figure IV-18 Generalized Geologic Section of Valley-Fill Aquifers through the Southern Portion of East Hanover Valley, Morris County

Source: Adapted from Vecchioli, Nichols and Nemickas, 1967, by U. S. Army Corps of Engineers, 1979.

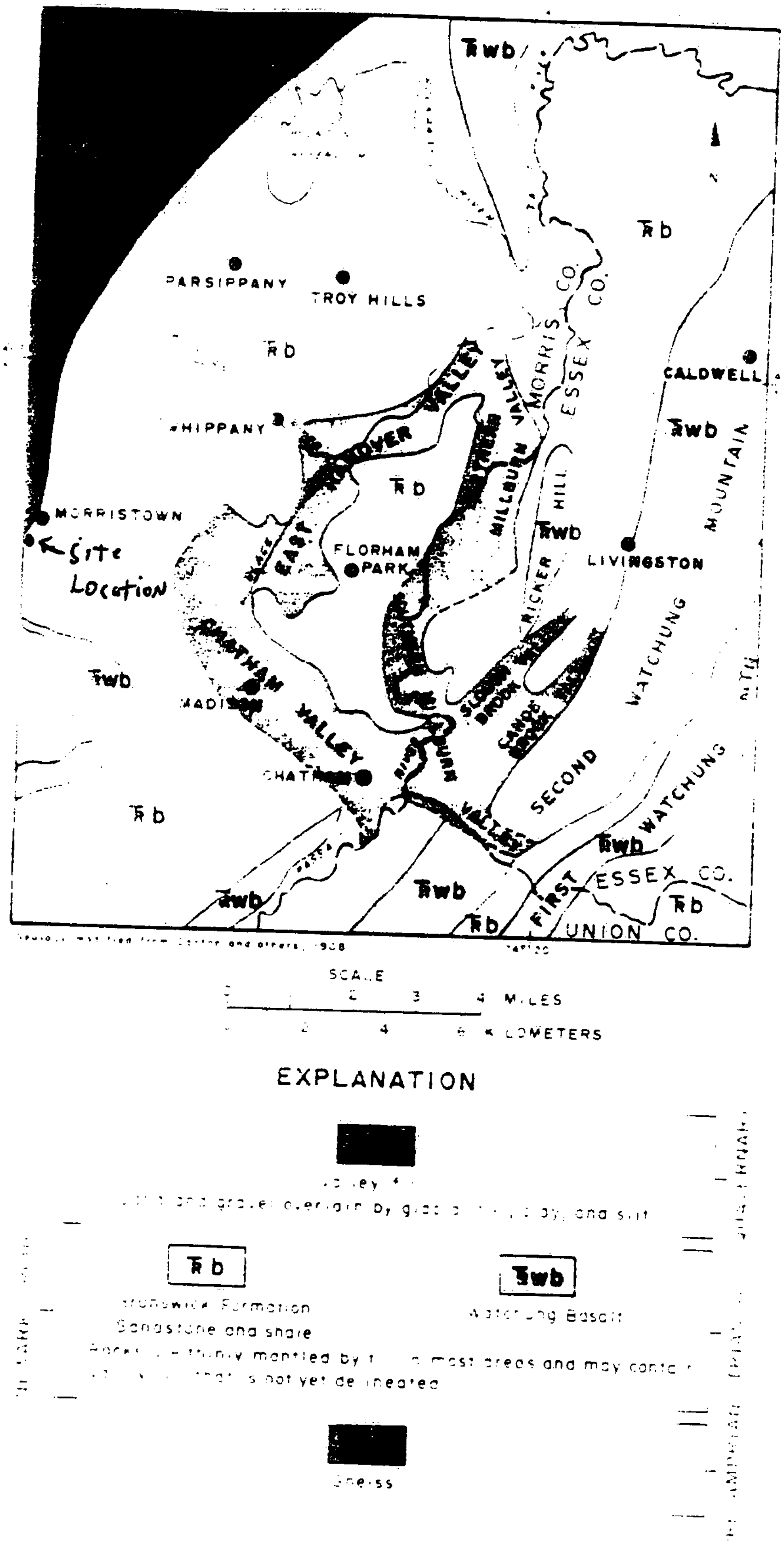


Figure IV-20 Generalized Geologic Map of Southwestern Essex and Southeastern Morris Counties

Source:

Hydraulic Connection Among Contiguous Aquifers

When the Wisconsin glacier moved into New Jersey, it scraped up vast quantities of soil and rock from the land surface, carrying them forward and depositing the materials in the terminal and ground moraines, as stratified drift and as silts and clays in Glacial Lake Passaic. In the buried valleys, geologists suggest that most or all of the soil from the sides of the valleys would have been stripped off. The stratified deposits which constitute the buried valley aquifers would thus be in direct contact with the bedrock aquifers, allowing free flow of water across the boundary (Meisler, 1976). In this manner, water which is recharged to the bedrock may serve to replenish a part of the water discharged from the buried valley aquifers through swamps and marshes, stream base flow, springs and wells (Nichols, 1968a). In some cases, the flow may be reversed, where water from the buried valleys enters the bedrock (especially where large wells draw from bedrock below or beside a buried valley).

The direction of flow depends on the hydraulic gradient; in other words, which direction is "downhill" for the water. Where the bedrock serves as a recharge source for a buried valley aquifer, the long-term productivity of the system is improved, overcoming the limitations caused by the narrow channels of the buried valleys (Geonics, 1979b).

The less permeable materials of a buried valley (fine sands, silts, clays, muck soils, nonstratified till) also can serve as valuable storage areas for water which can eventually recharge the sand and gravel aquifer. Fine sands, for example, are quite porous but relatively impermeable. They can hold large quantities of water but release it too slowly for major production wells. Over a wide area, these deposits could play a significant role in aquifer recharge (Geonics, 1979b).

Regional and Local Ground Water Flow

Ground water flows at a relatively slow pace, often measured in feet per day or even feet per year. The determination of ground water flow rates and directions is critically important in ground water contamination investigations, well zone protection, water budget preparation and the understanding of aquifers as systems rather than isolated components.

Ground water flow is described in "flow nets" which describe the three dimensional aspects of flow direction and velocity. As geologic conditions change, the ground water may flow faster or slower, over a broad area or through a restriction, up or down in elevation. However, ground water always flows along a gradient determined by gravity and pressure. Water table aquifers flow downgradient along the apparent surface of the aquifer. Confined aquifers also flow "down" but the gradient is measured differently, by the amount of pressure on the water at any point in the aquifer.

Natural ground water flow nets may change with precipitation. For instance, water may flow toward a river in wet seasons but away from the river in dry seasons. Natural flows may also be altered by pumping from the aquifer. In the vicinity of the pump, ground water will tend to flow toward the pump instead of in the natural (regional) flow direction because the pump artificially creates a depression in the aquifer. This depression becomes "down" for nearby water. Table IV-2 provides some measurements for the radius of influence of major wells in the region.

Research on ground water flow nets is lacking in the Buried Valley Aquifer Systems. Most of the data collected to date derive from contamination investigations, where mapping of the contaminant plume reveals the ground water flow. In most subregions and local areas of the aquifer systems, only the most limited understanding of flow exists. Precise flow nets have been determined in a very few areas, such as the Dover portion of the Rockaway Aquifer through USGS research.

Figure G-5 (in pocket) is a compilation of existing knowledge and inferrences about the flow of ground water to and within the buried valley aquifers. <u>This map should be used only as a general guide.</u> [1] Very little of the ground water flow information has been rigorously determined. Figure G-5 represents an initial attempt at mapping the gross flow net of the region. A final product will require considerable research, beyond the scope of this study. However, the map may be useful in defining the information needs for development and contamination review.

[1] Please inform the Passaic River Coalition of any new information which tends to support or oppose the regional flow net indicated on Figure G-5 or provides additional information in areas where no flow directions are indicated.

Parsippany and East Hanover (notably those of the Rockaway, Towaco and Great Piece Buried Valleys). 4.5 mgd were pumped from the Rockaway and Towaco valleys in 1975 (Geraghty & Miller, 1978). Estimates of pumpage are difficult to ascertain for the remaining valleys. However, Table V-2 indicates the approximate ground water use of Morris County municipality and nonpublic users in 1980, for communities in the designated areas. These data may be compared with Table V-3, listing ground water withdrawals in 1960 within the same region and segregating pumpage by aquifer tapped.

As of 1960, 77 per cent of the ground water use in Morris County came from stratified drift deposits. Gill and Vecchioli (1965) tabulated 127 large-diameter wells in Morris County, which yielded an average of 502 gpm from stratified drift (Table V-4).

In Essex County, Nichols noted the existence of 27 large-diameter wells in stratified drift, yielding an average of 908 gpm, and varying from 410 - 1,593 gpm (Table V-5).

20.0 mgd were pumped from stratified drift deposits in Essex County, comprising 81 per cent of the ground water used (a figure comparable to that of Morris County). Pumpage from Millburn alone was 15 mgd (Nichols, 1968a).

Overview of Public, Industrial and Private Uses

Use of ground water resources can be divided in many ways, but most useful is the dichotomy between major users and minor users (mostly residential). Major users, as defined by the NJ Department of Environmental Protection (NJDEP), are those withdrawing a monthly average of 100,000 gallons per day (gpd) or more (NJDEP, 1982). This diversion rate equates to a continuously operating well with a yield of 70 gallons per minute (gpm) or more, which is considerably smaller than many public supply wells (which often yield 500 gpm or more).

Many residential wells can yield 10 gpm on a more or less continuous basis, or 14,400 gpd, and yet the average personal use of water is perhaps 100 gpd. Obviously, a family of four does not appreciably tax the capacity of a good well. Further, homes which have both private wells and septic systems recharge much of the water used, resulting in minimal consumptive use of the ground water (Geraghty & Miller, 1978). Private wells are common in many of the less densely populated sections

TABLE V-2

PUBLIC COMMUNITY AND NONPUBLIC WATER CONSUMPTION BY MUNICIPALITY
BURIED VALLEY AQUIFER SYSTEMS, MORRIS COUNTY MUNICIPALITIES, 1980

Municipality	Total Population	Population Served by Public Supply	Per Capita Water Use	Avg. Water Use (MGD)	Population Served Nonpublic Supply	Avg. Water Use (MGD)
Boonton, Town of	8,620	8,620	132	1.14	---	---
Boonton Township	3,273	398	128	0.05	2,875	0.20
Chatham Borough	8,537	8,537	122	1.04	---	---
Chatham Township	8,883	7,540	81	0.61	1,343	0.09
Denville Township	14,380	12,942	134	1.73	1,438	0.10
Dover, Town of	14,681	14,681	161	2.36	---	---
East Hanover Township	9,319	7,428	148	1.10	1,891	0.13
Florham Park Borough	9,359	9,359	119	1.11	---	---
Hanover Township	11,846	11,846	126	1.49	---	---
Harding Township	3,236	891	127	0.11	2,345	0.16
Jefferson Township	16,413	6,602	58	0.38	9,811	0.69
Kinnelon Township	7,770	3,980	65	0.26	3,790	0.27
Madison Borough	15,357	15,357	124	1.90	---	---
Mendham Borough	4,899	4,899	131	0.64	---	---
Mendham Township	4,488	1,511	86	0.13	2,977	0.21
Mine Hill Township	3,325	1,531	91	0.14	1,794	0.13
Montville Township	14,290	6,291	155	0.98	7,999	0.56
Morris Plains Borough	5,305	5,305	111	0.59	---	---
Morristown, Town of	16,614	16,614	102	1.69	---	---
Morris Township	18,486	15,354	119	1.83	3,132	0.22
Mountain Lakes Borough	4,153	4,153	149	0.62	---	---
Parsippany-Troy Hills Twp	49,868	49,868	112	5.59	---	---
Passaic Township	7,275	6,564	81	0.53	711	0.05

TABLE V-2 (Cont'd)

Municipality	Total Population	Population Served by Public Supply	Per Capita Water Use	Avg. Water Use (MGD)	Population Served Nonpublic Supply	Avg. Water Use (MGD)
Randolph Township	17,828	10,523	116	1.22	7,305	0.51
Rockaway Borough	6,852	6,852	124	0.85	---	---
Rockaway Township	19,850	13,910	89	1.24	5,940	0.42
Roxbury Township	18,878	13,732	89	1.22	5,146	0.36
Victory Gardens Borough	1,043	1,043	161	0.17	---	---
Wharton Borough	5,485	5,485	128	0.70	---	---
	325,306	271,816		31.42	53,490	4.10

Source: Adapted from Killam Associates, 1982, Water Supply Element-Morris County Master Plan, prepared for the Morris County Planning Board.

TABLE V-3

GROUND WATER WITHDRAWAL IN THE
BURIED VALLEY AQUIFER SYSTEMS,
MORRIS COUNTY MUNICIPALITIES, 1960

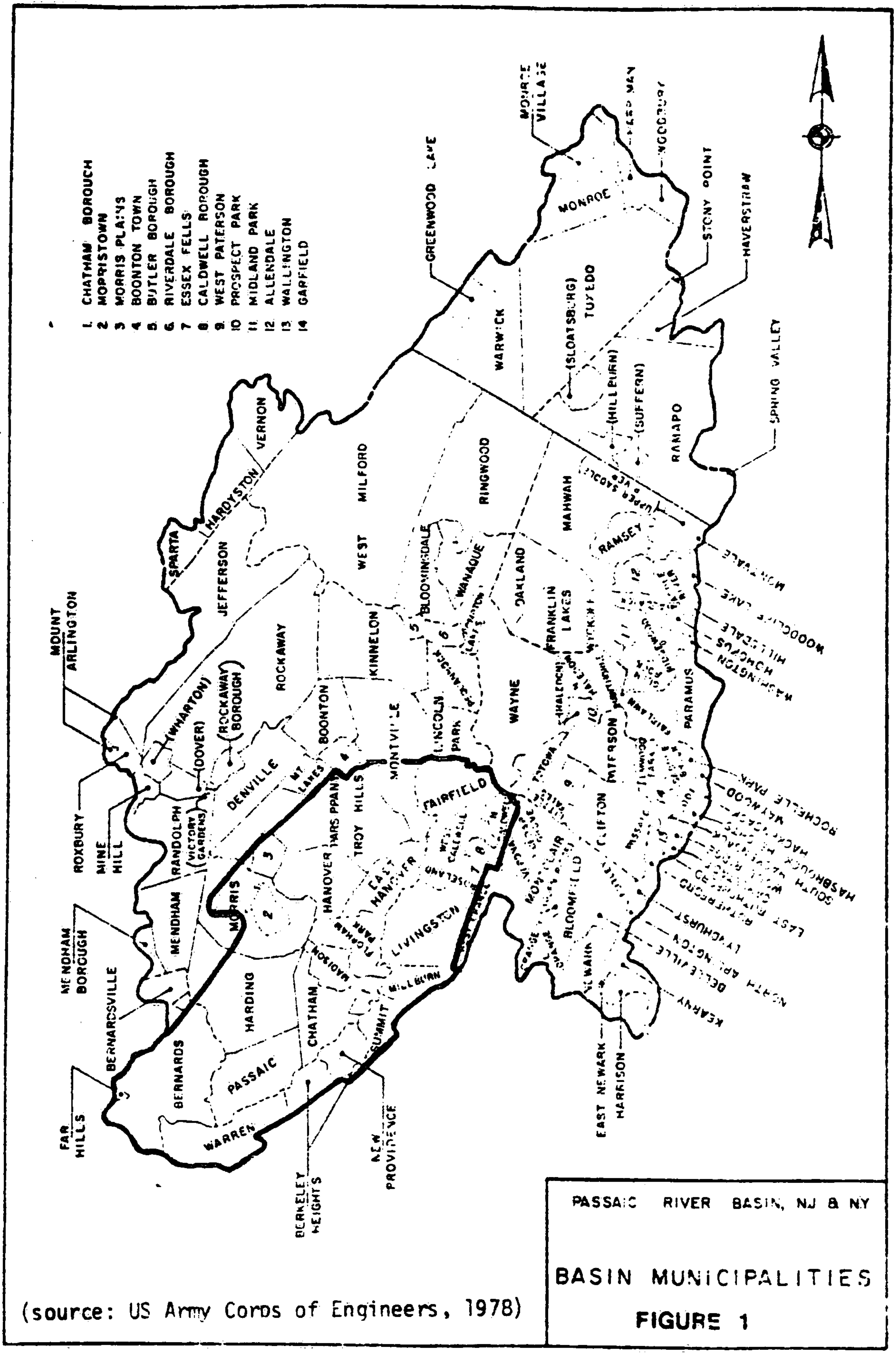
Municipality	Average Daily Use (MGD)				Use by Aquifer (MGD)			
	Public Supply	Commercial, Industrial Institutional	Other	TOTAL	Precambrian	Paleozoic	Triassic	Quaternary
Boonton, Town of	0	0.40	0	0.40	0.40	0	0	0
Boonton Township	1.275	0.029	0.10	1.374	0.074	0	0	1.30
Chatham Borough	0.711	0.02	0	0.731	0	0	0.020	0.711
Chatham Township	0	0	0.050	0	0	0	0.025	0.025
Denville Township	1.401	0.249	0	1.650	0.001	0	0	2.552
Dover, Town of	2.062	0.490	0	2.522	0	0	0	2.522
East Hanover Township	0	0.130	0.226	0.356	0	0	0.151	0.205
Florham Park Borough	2.108	0.555	0.050	2.713	0	0	0.075	2.638
Hanover Township	2.142	2.397	0.250	4.789	0	0	0.500	4.289
Harding Township	0.201	0	0.135	0.336	0.100	0	0.201	0.035
Jefferson Township	0.060	0	0.250	0.310	0.150	0.060	0	0.100
Kinnelon Township	0.085	0	0.130	0.215	0.115	0	0	0.100
Madison Borough	1.239	0	0	1.239	0	0	0	1.239
Mendham Borough	0.123	0	0	0.123	0.123	0	0	0
Mendham Township	0	0	0.100	0.100	0.100	0	0	0
Mine Hill Township	0.010	0.600	0.150	0.760	0.160	0	0	0.600
Montville Township	0.029	0.145	0.300	0.474	0.300	0	0.174	0
Morris Plains Borough	0	0.576	0.300	0.876	0.176	0	0.200	0.500
Morristown, Town of	0	1.826	0	1.826	0.216	0	0.120	1.490
Morris Township	0	0.272	0	0.272	0	0	0.272	0
Mountain Lakes Borough	0	0.020	0	0.020	0.010	0	0	0.010
Parsippany-Troy Hills Twp	2.038	0.386	0.300	2.724	0.600	0	0.124	2.000
Passaic Township	0	0	0.050	0.050	0	0	0.040	0.010

TABLE V-3

Municipality	Average Daily Use (MGD)				Use by Aquifer (MGD)			
	Public Supply	Commercial, Industrial Institutional	Other	TOTAL	Precambrian	Paleozoic	Triassic	Quaternary
Randolph Township	0.065	0.064	0.300	0.429	0.300	0	0	0.129
Rockaway Borough	0.781	0.131	0	0.912	0.131	0	0	0.781
Rockaway Township	0.097	0.564	0.150	0.811	0.150	0.061	0	0.600
Roxbury Township	0.429	1.631	0.325	2.385	0.085	0.300	0	2.000
Victory Gardens Borough	0	0	0	0	0	0	0	0
Wharton Borough	0.525	0.005	0	0.530	0.005	0	0	0.525
	-----	-----	-----	-----	-----	-----	-----	-----
Totals	15.351	10.490	3.166	29.407	3.196	0.421	1.902	23.488

Note: The withdrawals by municipality in Table V-3 are not directly comparable with the withdrawal data in TableV-2. Table V-3 is according to the location of diversion, while Table V-2 indicates the location of use.

Source: Adapted from Gill and Vecchioli, 1965.



(source: US Army Corps of Engineers, 1978)

PASSAIC RIVER BASIN, NJ & NY

BASIN MUNICIPALITIES

FIGURE 1

AREA PROPOSED FOR SOLE SOURCE AQUIFER DESIGNATION

(South Central Basin)

REFERENCE NO. 12

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USGS Well Inventory

MORRIS COUNTY, NJ

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U. S. GEOLOGICAL SURVEY TRENTON, NEW JERSEY

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SELECTED INFORMATION OF WELLS FROM THE GROUND WATER [illegible]
MORRIS COUNTY

USGS UNIQUE ID	SITE ID	LATITU	LONGTU	MUNICIPALITY	SITE OWNER	LOCAL IDENTIFIER	DATE COMPLETED	USE OF SITE	ORIG WATER USE	CURR WATER USE	LAT LON ACC
270137	405408074303101	405408	743031	ROCKAWAY BORO	ROCKAWAY BORO WD	RBWD 1	09/05/1922	W	P	P	S
270138	405342074305701	405342	743057	ROCKAWAY BORO	ROCKAWAY BORO WD	RBWD 3	02/20/1943	W	P	P	S
270139	405405074303701	405405	743037	ROCKAWAY BORO	ROCKAWAY BORO WD	RBWD 4	09/10/1956	W	P	P	S
270140	404705074243101	404705	742431	FLORHAM PARK BORO	FLORHAM PARK WD	FPBWD 1	06/02/1941	W	P	P	F
270141	404723074242401	404723	742424	FLORHAM PARK BORO	FLORHAM PARK WD	FPBWD 2	08/00/1953	W	F	P	F
270142	404708074240801	404708	742408	FLORHAM PARK BORO	FLORHAM PARK WD	FPBWD 3	11/00/1964	W	P	P	F
270143	404709074243701	404709	742437	FLORHAM PARK BORO	FLORHAM PARK WD	FPWD 4	07/29/1980	W	F	P	F
270144	404656074223401	404656	742234	FLORHAM PARK BORO	FLORHAM PARK WD	FPBWD TW 1	07/24/1952	T	F	P	F
270145	404755074240801	404755	742408	FLORHAM PARK BORO	WILBUR B DRIVER CO	1	10/19/1962	W	N	N	F
270146	404721074265701	404720	742655	MORRIS TWP	ALLIED CHEMICAL CO	4	10/23/1969	W	N	N	F
270147	404856074233901	404856	742325	EAST HANOVER TWP	EAST HANOVER TWP WD	EHTWD 2	03/15/1967	W	F	P	S
270148	405009074211701	405009	742117	EAST HANOVER TWP	EAST HANOVER TWP WD	EHTWD 5	08/14/1972	W	P	F	S
270149	404854074205301	404854	742053	EAST HANOVER TWP	EAST HANOVER TWP WD	EHTWD 3	11/11/1960	W	P	U	T
270150	404349074251601	404349	742516	CHATHAM TWP	US GEOL SURVEY	GS TH 4	08/18/1981	O	U	U	S
270151	404417074261601	404417	742616	CHATHAM TWP	US GEOL SURVEY	GS TH 5	08/25/1981	O	U	U	S
270152	404450074245901	404450	742459	MADISON BORO	US GEOL SURVEY	TM TH 1	08/22/1981	O	U	U	S
270153	404707074283901	404707	742839	MORRISTOWN TOWN	SE MORRIS CO MUA	LIDGERWOOD 5	11/07/1967	W	P	P	F
270154	405020074273901	405020	742739	PARSIP-TROY HILLS	SE MORRIS CO MUA	LITTLETON 1	00/00/1927	W	F	P	S
270155	405018074274501	405018	742745	PARSIP-TROY HILLS	SE MORRIS CO MUA	LITTLETON 2	12/00/1939	W	P	P	S
270156	404733074255101	404733	742551	HANOVER TWP	SE MORRIS CO MUA	NORMANDY	12/00/1946	W	F	P	F
270157	404709074290201	404709	742902	MORRISTOWN TOWN	SE MORRIS CO MUA	OVERLOOK	05/03/1966	W	P	P	F
270158	404545074301801	404545	743018	HARDING TWP Nearest P.S. Well	SE MORRIS CO MUA	SAND SPRINGS	09/26/1942	W	P	P	S
270159	404941074300601	404941	743006	MORRIS TWP	SE MORRIS CO MUA	SHONGUN WELL	00/00/1968	W	P	P	S
270160	404952074263201	404952	742632	HANOVER TWP	SE MORRIS CO MUA	TODD	11/04/1954	W	P	P	S
270161	404709074275201	404709	742752	MORRISTOWN TOWN	SE MORRIS CO MUA	TURNBULL	12/16/1965	W	P	P	S
270162	404955074264101	404955	742641	HANOVER TWP	SE MORRIS CO MUA	WING WELL	07/30/1948	W	F	P	S
270163	405211074254301	405211	742543	PARSIP-TROY HILLS	PARSIP-TROY HILLS WD	PTHWD 1-OBS	11/02/1931	W	F	U	S
270164	405207074254601	405207	742546	PARSIP-TROY HILLS	PARSIP-TROY HILLS WD	PTHWD 1A	09/00/1958	W	F	F	F
270165	405219074255601	405219	742556	PARSIP-TROY HILLS	PARSIP-TROY HILLS WD	PTHWD 2	00/00/1937	W	F	P	S
270166	405220074235801	405220	742358	PARSIP-TROY HILLS	PARSIP-TROY HILLS WD	PTHWD 3	11/00/1944	W	P	P	F
270167	405207074251301	405207	742513	PARSIP-TROY HILLS	PARSIP-TROY HILLS WD	PTHWD 4	03/00/1951	W	F	P	S
270168	405206074251101	405206	742511	PARSIP-TROY HILLS	PARSIP-TROY HILLS WD	PTHWD 4A	05/00/1958	W	P	P	S
270169	405130074283501	405130	742835	PARSIP-TROY HILLS	PARSIP-TROY HILLS WD	PTHWD 5-1	07/25/1953	W	F	U	F
270170	405134074283401	405134	742834	PARSIP-TROY HILLS	PARSIP-TROY HILLS WD	PTHWD 5-2	03/24/1954	W	F	U	F
270171	405137074283301	405137	742833	PARSIP-TROY HILLS	PARSIP-TROY HILLS WD	PTHWD 5-3	04/16/1954	W	P	U	F
270172	405139074283101	405139	742831	PARSIP-TROY HILLS	PARSIP-TROY HILLS WD	PTHWD 5-4	04/10/1954	W	P	U	F
270173	405139074210901	405139	742109	PARSIP-TROY HILLS	PARSIP-TROY HILLS WD	PTHWD 6	00/00/1956	W	F	P	F
270174	405139074210902	405139	742109	PARSIP-TROY HILLS	PARSIP-TROY HILLS WD	PTHWD TW 6	10/00/1954	T	U	U	F
270175	405102074250201	405102	742502	PARSIP-TROY HILLS	PARSIP-TROY HILLS WD	PTHWD 7	07/22/1958	W	F	P	F
270176	405037074233901	405037	742339	PARSIP-TROY HILLS	PARSIP-TROY HILLS WD	PTHWD 8-1	07/00/1963	W	F	P	F
270177	405032074234301	405032	742343	PARSIP-TROY HILLS	PARSIP-TROY HILLS WD	PTHWD 8-2	07/00/1963	W	P	P	F
270178	405035074233701	405035	742337	PARSIP-TROY HILLS	PARSIP-TROY HILLS WD	PTHWD 8-3	07/00/1963	W	P	P	F
270179	405211074260701	405211	742607	PARSIP-TROY HILLS	PARSIP-TROY HILLS WD	PTHWD 9	09/30/1964	W	F	P	F

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SELECTED INFORMATION FROM WELLS IN THE GROUND WATER SITE INVENTORY DATABASE
MORRIS COUNTY

USGS UNIQUE ID	WELL DEPTH	AQUIFER CODE	DATA RELIABILITY	HYDROLOGIC UNIT	DRILLER	MIN CASING DIA	SITE TYPE	NJDEP PERMIT NUMBER	NJDEP GRID NUMBER	WATER ALLOC NUMBE	STAN INDUS USE	LIFT TYPE	TIME PERIOD PUMPED	SPECIFIC CAPACITY	ALTITUDE WATER LEVEL	MU CI CO
70137	48.67	112SDGV	U	02030103	LAYNE NY CO	24.0	W		2503297		4941	T	0.0	13.31	516.00	34
70138	145.00	112SDGV	U	02030103	LAYNE NY CO	12.0	W		2503525		4941	T	8.0	8.84	557.50	34
70139	94.00	112SDGV	U	02030103	LAYNE NY CO	12.0	W	2505892	2503531		4941	T	8.0	6.27	511.00	34
70140	92.00	112SDGV	U	02030103	LAUMAN, CW	12.0	W		2514565		4941		24.0	0.00	186.00	11
70141	111.00	112SDGV	U	02030103	ARTESIAN CO	16.0	W		2514562		4941		0.0	0.00	0.00	11
70142	133.00	112SDGV	U	02030103	ARTESIAN CO	22.0	W				4941		4.0	18.85	183.00	11
70143	139.00	112SDGV	U	02030103	ARTESIAN CO	14.0	W	2121204	2514562		4941	T	72.0	49.82	163.00	11
70144	128.00	112SDGV	U	02030103	ARTESIAN CO	6.0	W	2501830	2514634		4941		4.0	13.33	131.00	11
70145	102.00	112SDGV	U	02030103	STOTHOFF, WM	12.0	W	2510880			3612		8.0	46.90	189.00	11
70146	203.00	112SDGV	U	02030103	STOTHOFF, WM	8.0	W	2515313		00785	2812		72.0	6.09	267.00	22
70147	115.00	112SDGV	C	02030103	BEATTY, WM	12.0	W	2514205	2514349	05072	4941		48.0	39.47	178.00	10
70148	84.30	112SDGV	C	02030103	RINBRAND CO	12.0	W	2518267	2515112	05072	4941		0.0	0.00	0.00	10
70149	270.00	231BRCK	U	02030103	STOTHOFF, WM	8.0	W	2509640	2515155	05072	4941		8.0	0.52	175.00	10
70150	112.50	112SDGV	C	02030103		2.0	W						0.0	0.00	0.00	5
70151	92.50	112SDGV	C	02030103		2.0	W						0.0	0.00	0.00	5
70152	172.50	112SDGV	C	02030103		2.0	W						0.0	0.00	0.00	17
70153	265.00	231BRCK	U	02030103	BURROWS CO	12.0	W	2514520		01440	4941		0.0	7.27	260.00	24
70154	75.00	112SDGV	U	02030103	KELLY CO	24.0	W				4941	T	96.0	15.38	319.00	29
70155	75.00	112SDGV	U	02030103		24.0	W				4941	T	96.0	15.38	329.00	29
70156	75.00	112SDGV	U	02030103		17.0	W		2514517		4941	T	0.0	0.00	0.00	12
70157	442.00	231BRCK	C	02030103	ARTESIAN CO	12.0	W	2513593			4941		72.0	2.67	295.00	24
70158 ✓	94.00	231BRCK	U	02030103	LAUMAN, CW	24.0	W	2502502	2513835		4941		72.0	13.40	296.50	13
70159	0.00		U	02030103		0.0	W				4941		0.0	0.00	0.00	22
70160	144.00	112SDGV	U	02030103	ARTESIAN CO	17.0	W	2503527	2514131		4941		8.0	55.36	258.00	12
70161	496.00	231BRCK	C	02030103	STOTHOFF, WM	12.0	W	2513439			4941		0.0	2.64	251.50	24
70162	118.00	112SDGV	U	02030103	KELLY CO	17.0	W	2500048	2514134		4941	C	72.0	125.00	277.00	12
70163	134.75	112SDGV	C	02030103	LAYNE NY CO	16.0	W		2504579	00383	4941	C	0.0	37.25	284.00	29
70164	138.00	112SDGV	U	02030103	ARTESIAN CO	8.0	W		2504579		4941		0.0	16.78	273.75	29
70165	145.00	112SDGV	C	02030103		16.0	W		2504578		4941		0.0	0.00	301.00	29
70166	75.00	112SDGV	U	02030103		16.0	W		2504677		4941	T	12.0	31.58	270.00	29
70167	79.00	112SDGV	C	02030103	FEAKINS CO	16.0	W		2504588		4941	T	8.0	8.47	287.00	29
70168	150.00	112SDGV	C	02030103	BEATTY, WM	10.0	W		2504588		4941	T	0.0	0.00	0.00	29
70169	150.00	400PCMB	U	02030103	GOULD, LC	8.0	W		2503961		4941		8.0	8.33	362.00	29
70170	195.00	400PCMB	U	02030103	STOTHOFF, WM	8.0	W	2503169	2503961	00780	4941		12.0	2.89	513.00	29
70171	150.00	400PCMB	U	02030103	STOTHOFF, WM	6.0	W	2503168	2503961		4941		12.0	7.05	532.00	29
70172	150.00	400PCMB	U	02030103	STOTHOFF, WM	8.0	W	2503167	2503961		4941		12.0	2.05	550.00	29
70173	90.00	112SDGV	U	02030103	ARTESIAN CO	17.0	W		2505725		4941	U	0.0	0.00	0.00	29
70174	86.00	112SDGV	U	02030103	BURROWS CO	6.0	W						0.0	0.00	0.00	29
70175	65.00	112SDGV	U	02030103	ARTESIAN CO	16.0	W	2507620	2504854		4941		0.0	16.25	273.00	29
70176	68.00	112SDGV	U	02030103		12.0	W				4941	T	0.0	0.00	0.00	29
70177	61.00	112SDGV	U	02030103		12.0	W				4941	T	0.0	0.00	0.00	29
70178	70.00	112SDGV	U	02030103		12.0	W				4941	T	0.0	0.00	0.00	29
70179	80.00	112SDGV	U	02030103		16.0	W				4941	T	0.0	0.00	250.00	29

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Started: 86-01-13.14:49:48.Mon on: PRO by: BIG

U. S. GEOLOGICAL SURVEY TRENTON, NEW JERSEY

USGS UNIQUE ID	ALTITUD	METH ALT MEAS	ALTITUDE ACC	WATER LEVEL	DATE LEVEL MEASURED	PRODUCTION LEVEL	DISCHARG	DEPTH FIRST OPENING	BOTTOM LAST OPENING	MIN OPEN DIA	OPENING LENGT	TYPE OPEN-ING	TYPE OPEN MAT	BEDROCK DEPTH	BEDROCK MATERIAL	DEPTH DRILLER LOG
270137	520.00	M	10.00	4.00	/ /	30.00	346.00	39.00	48.67	24.0	9.7	S		0.00		49.00
270138	560.00	M	10.00	2.50	/ /	93.00	800.00	100.00	140.00	12.0	40.0	L		0.00		140.00
270139	520.00	M	10.00	9.00	/ /	65.00	351.00	69.00	84.00	12.0	15.0	S		0.00		85.17
270140	190.00	M	10.00	4.00	/ /	0.00	360.00	70.00	82.00	12.0	12.0	S		0.00		85.00
270141	190.00	M	10.00	3.00	/ /	0.00	1040.00	80.00	110.00	16.0	30.0	S		0.00		0.00
270142	190.00	M	10.00	7.00	/ /	46.00	735.00	67.00	103.00	22.0	36.0	S	C	0.00		103.00
270143	210.00	M	10.00	47.00	/ /	75.00	1395.00	89.00	139.00	14.0	50.0	S		0.00		140.00
270144	190.00	M	10.00	59.00	/ /	65.00	80.00	118.00	128.00	6.0	10.0	S		0.00		128.00
270145	190.00	M	10.00	1.00	/ /	30.00	1360.00	72.00	102.00	12.0	30.0	P	R	0.00		108.00
270146	280.00	M	10.00	113.00	/ /	167.00	329.00	185.00	203.00	8.0	18.0	P	R	228.00	SHLE	253.00
270147	190.00	M	10.00	12.00	/ /	50.00	1500.00	85.00	115.00	12.0	30.0	S	R	125.00	SHLE	125.00
270148	190.00	M	10.00	9.00	/ /	0.00	0.00	65.30	84.30	12.0	19.0	P	R	116.00		119.00
270149	190.00	M	10.00	17.00	/ /	150.00	70.00	139.08	270.00	0.0	130.9	X		131.00	SNDS	0.00
270150	250.00	A	5.00	0.00	/ /	0.00	0.00	110.00	112.50	1.3	2.5	T	G	136.00	SHLE	137.50
270151	250.00	M	10.00	0.00	/ /	0.00	0.00	90.00	92.50	1.3	2.5	T	G	0.00		0.00
270152	260.00	M	10.00	9.30	/ /	0.00	0.00	170.00	172.50	1.3	2.5	T	G	213.00	SHLE	213.00
270153	300.00	M	10.00	49.00	/ /	150.00	800.00	67.83	265.00	0.0	197.2	X		46.00	SNDS	265.00
270154	320.00	M	10.00	1.00	/ /	40.00	600.00	69.00	75.00	24.0	15.0	P	C	0.00		0.00
270155	330.00	M	10.00	1.00	/ /	40.00	600.00	60.00	75.00	24.0	15.0	P	C	0.00		0.00
270156	210.00	M	10.00	0.00	/ /	0.00	0.00	42.50	75.00	17.0	32.5	P	C	70.00	SHLE	79.42
270157	300.00	M	10.00	5.00	/ /	108.00	275.00	86.00	442.00	0.0	356.0	X		57.00	SHLE	442.00
270158	300.00	M	10.00	3.50	/ /	52.00	650.00	36.00	94.00	0.0	58.0	X		36.00	SHLE	94.00
270159	410.00	M	10.00	0.00	/ /	0.00	0.00	0.00	0.00	0.0	0.0			0.00		0.00
270160	280.00	M	10.00	22.00	/ /	50.00	1550.00	94.00	144.00	17.0	50.0	S		144.00		144.00
270161	300.00	L	5.00	38.50	/ /	200.00	400.00	124.00	496.00	0.0	372.0	X		120.00	SHLE	496.00
270162	280.00	M	10.00	3.00	/ /	11.00	1000.00	88.00	118.00	17.0	30.0	P	C	0.00		133.00
270163	300.00	M	10.00	15.00	/ /	36.00	745.00	106.75	136.75	16.0	30.0	L		0.00		150.83
270164	300.00	M	10.00	25.25	/ /	62.00	600.00	102.00	138.00	8.0	36.0	P		0.00		144.00
270165	310.00	M	10.00	9.00	/ /	0.00	600.00	57.00	145.00	16.0	88.0	S		0.00		190.00
270166	300.00	M	10.00	30.00	/ /	49.00	600.00	49.00	75.00	16.0	26.0	S		93.00	SHLE	98.00
270167	300.00	M	10.00	13.00	/ /	72.00	500.00	52.00	79.00	16.0	27.0	S		0.00		143.00
270168	300.00	M	10.00	0.00	/ /	32.00	790.00	120.00	150.00	10.0	30.0	P		0.00		150.00
270169	480.00	M	10.00	118.00	/ /	136.00	150.00	52.00	150.00	0.0	98.0	X		43.00		150.00
270170	525.00	M	10.00	7.00	/ /	98.00	263.00	38.00	195.00	0.0	157.0	X		35.00		195.00
270171	541.00	M	10.00	8.00	/ /	65.00	402.00	39.75	150.00	0.0	110.3	X		35.00		150.00
270172	560.00	M	10.00	10.00	05/08/1954	105.00	195.00	32.33	150.00	0.0	117.7	X		30.00		150.00
270173	180.00	M	10.00	0.00	/ /	0.00	350.00	54.00	90.00	17.0	36.0	S	C	90.00	SHLE	90.00
270174	180.00		10.00	0.00	/ /	0.00	0.00	75.00	86.00	0.0	11.0	X		86.00		86.00
270175	280.00	M	10.00	7.00	/ /	51.00	715.00	55.25	65.00	16.0	9.8	R		0.00		66.00
270176	180.00	M	10.00	0.00	/ /	0.00	0.00	40.00	60.00	12.0	20.0	S		65.00	SHLE	65.00
270177	180.00	M	10.00	0.00	/ /	0.00	0.00	40.00	60.00	12.0	20.0	S		65.00	SHLE	65.00
270178	180.00	M	10.00	0.00	/ /	0.00	0.00	40.00	70.00	12.0	30.0	S		70.00	SHLE	70.00
270179	280.00	M	10.00	59.00	/ /	0.00	750.00	60.00	80.00	16.0	20.0	S		0.00		80.00

1/13/86

SELECTED INFORMATION FROM WELLS IN THE GROUND WATER SITE INVENTORY DATABASE
MORRIS COUNTY

USGS UNIQUE ID	WELL DEPTH	AGUIFER CCDE	DATA RELIA-BILITY	HYDRO-LOGIC UNIT	CRILLER	MIN CASING DIA	SITE TYPE	NJDEP PERMIT NUMBER	NJDEP GRID NUMBER	WATER ALLOC NUMRE	STAN INDUS USE	LIFT TYPE	TIME PERIOD PUMPED	SPECIFIC CAPACITY	ALTITUDE WATER LEVEL	MU CI CO
270180	129.00	112SDGV	C	02030103		12.0	W				4541		0.0	0.00	250.00	29
270181	80.00	112SDGV	U	02030103		14.0	W				4941		0.0	0.00	190.00	29
270182	47.00	112SDGV	U	02030103		0.0	W				4941		0.0	0.00	0.00	29
270183	86.42	112SDGV	U	02030103		0.0	W				4941		0.0	0.00	275.00	29
270184	87.00	112SDGV	U	02030103		0.0	W				4941		0.0	0.00	174.00	29
270185	134.00	112SDGV	U	02030103	DE NURE, WM	14.0	W				4941		0.0	0.00	0.00	29
270186	100.00	112SDGV	U	02030103		0.0	W						0.0	0.00	0.00	29
270187	150.00	112SDGV	C	02030103		12.0	W				4941		0.0	4.76	498.00	35
270188	462.00	400PCMB	U	02030103	REILLY, JJ	7.0	W		2504429		4941		0.0	0.00	0.00	25
270189	64.00	112SDGV	U	02030103	KELLY CO	17.0	W		2504178	00248	4941	C	16.0	23.33	485.00	8
270190	64.00	112SDGV	U	02030103	KELLY CO	17.0	W		2504178	00248	4941	C	16.0	29.63	489.00	8
270191	332.00	112SDGV	U	02030103	LAUMAN CO	8.0	W	2514698		01472	4941		0.0	0.00	396.00	25
270192	0.00	231BRCK	U	02030103		6.0	W				8811		5.0	0.45	178.00	21
270193	205.00	231BRCK	U	02030103	PINE BRK CC	6.0	W	2510668			9111		6.0	0.22	186.00	21
270194	0.00	231BSLT	U	02030103		0.0	W				4941		0.0	0.00	0.00	21
270195	290.00	231BSLT	U	02030103		8.0	W				4941		5.0	0.00	0.00	21
270196	293.00	211MRPA	U	02030103	DF WELL CO	8.0	W	2513895		01367	4941		16.0	2.36	120.00	21
270197	112.00	211MRPA	U	02030103	PINE BRK CC	8.0	W				4941	U	8.0	0.58	375.00	21
270198	243.00	112SDGV	U	02030103	BURROWS CO	12.0	W	2213923		01653	4941		72.0	5.44	186.08	21
270199	416.00	400PCMB	U	02030103	ARTESIAN CO	10.0	W	2500621	2504296		3911		8.0	0.08	368.50	2
270200	92.00	112SDGV	U	02030103		6.0	W		2514667				0.0	1.47	180.00	11
270201	104.00	112SDGV	U	02030103		6.0	W	2502193	2514562				0.0	0.00	157.00	11
270202	68.00	112SDGV	U	02030103	STEWART & CO	8.0	W		2514565				0.0	0.00	0.00	11
270203	126.00	112SDGV	U	02030103	ARTESIAN CO	10.0	W		2514941		4941		0.0	48.95	173.00	17
270204	129.00	112SDGV	U	02030103	ARTESIAN CO	10.0	W		2514941		4941		0.0	41.67	175.00	17
270205	140.00	112SDGV	U	02030103	ARTESIAN CO	10.0	W		2514941		4941		0.0	30.59	181.00	17
270206	430.00	231BRCK	U	02030103	LAUMAN CO	8.0	W	2603003		05070			2.0	1.32	175.00	16
270207	60.00	231BRCK	U	02030103	LAUMAN CC	8.0	W	2603029	2601532	05070			0.0	0.00	167.00	16
270208	400.00	231BRCK	U	02030103	LAUMAN CO	8.0	W	2603029		05070			0.0	0.00	165.00	16
270209	600.00	231BRCK	U	02030103	STOTHOFF, WM	12.0	W	2511968	2514455		3612		24.0	1.38	265.00	22
270210	141.00	112SDGV	U	02030103	STOTHCFF, WM	6.0	W	2515105	2513633		8811	S	6.0	7.50	258.00	24
270211	40.00	112SDGV	U	02030103	KNIGHT CC	5.0	W		2514355		3612		0.0	0.00	0.00	10
270212	111.33	112SDGV	U	02030103	LAYNE NY CO	8.0	W		2514356				0.0	0.00	0.00	10
270213	761.00	231BRCK	U	02030103	BOTT, F	6.0	W	2504286	2514438		2812		0.0	1.64	220.00	22
270214	172.00	112SDGV	U	02030103	STOTHOFF, WM	12.0	W	2509253	2514439	2117P	2812	U	24.0	14.16	225.00	22
270215	273.00	112SDGV	U	02030103	DF WELL CO	6.0	W	2518980	2514437				0.0	0.00	0.00	22
270216	231.00	112SDGV	U	02030103	CF WELL CO	6.0	W	2518982	2514438				0.0	0.00	0.00	22
270217	172.00	112SDGV	U	02030103	DF WELL CO	6.0	W	2518984	2514438				0.0	0.00	0.00	22
270218	186.75	112SDGV	U	02030103	LAYNE NY CO	6.0	W						0.0	0.00	234.00	22
270219	185.00	112SDGV	U	02030103	LAYNE NY CO	6.0	W						0.0	0.00	0.00	22
270220	0.00	112SDGV	U	02030103		0.0	W		2514518				0.0	0.00	0.00	12
270221	0.00	112SDGV	U	02030103		0.0	W		2503989				0.0	0.00	0.00	23
270222	0.00	112SDGV	U	02030103		0.0	W		2503989				0.0	0.00	0.00	23

REFERENCE NO. 13

Uncontrolled Hazardous Waste Site Ranking System

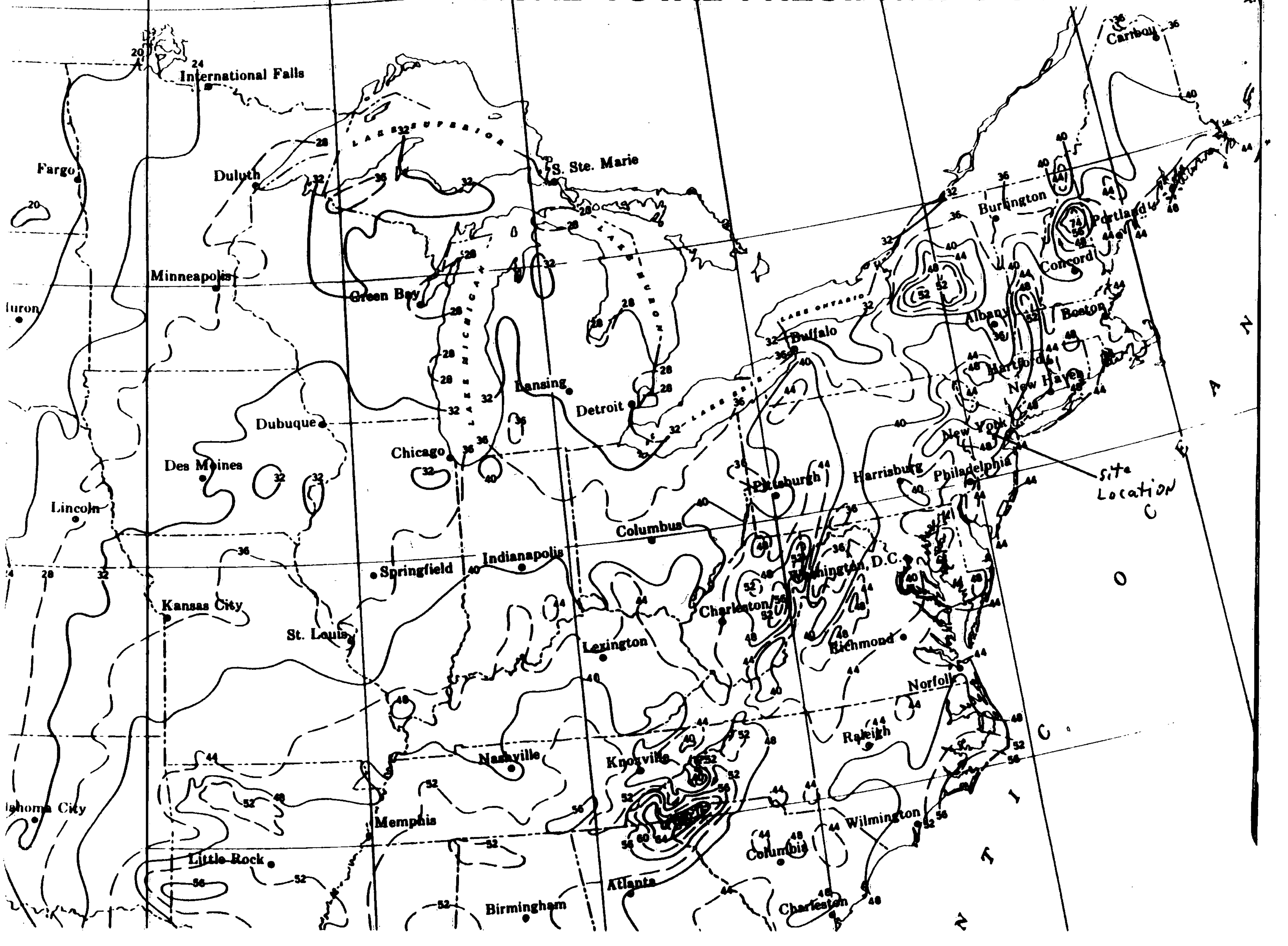
A Users Manual
(HW-10)

Originally Published in
the July 16, 1982, *Federal Register*

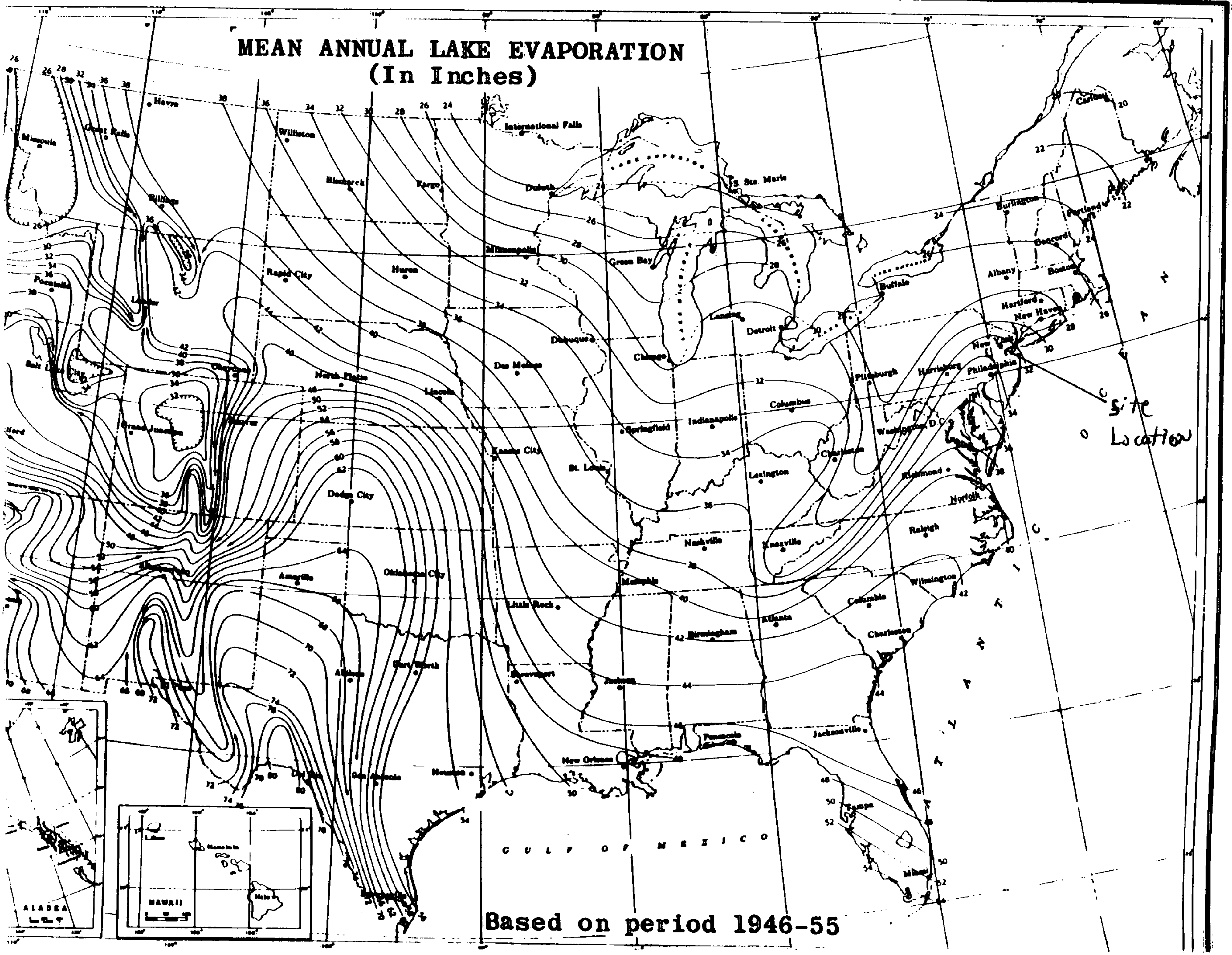
United States
Environmental Protection
Agency

1984

NORMAL ANNUAL TOTAL PRECIPITATION (Inches)

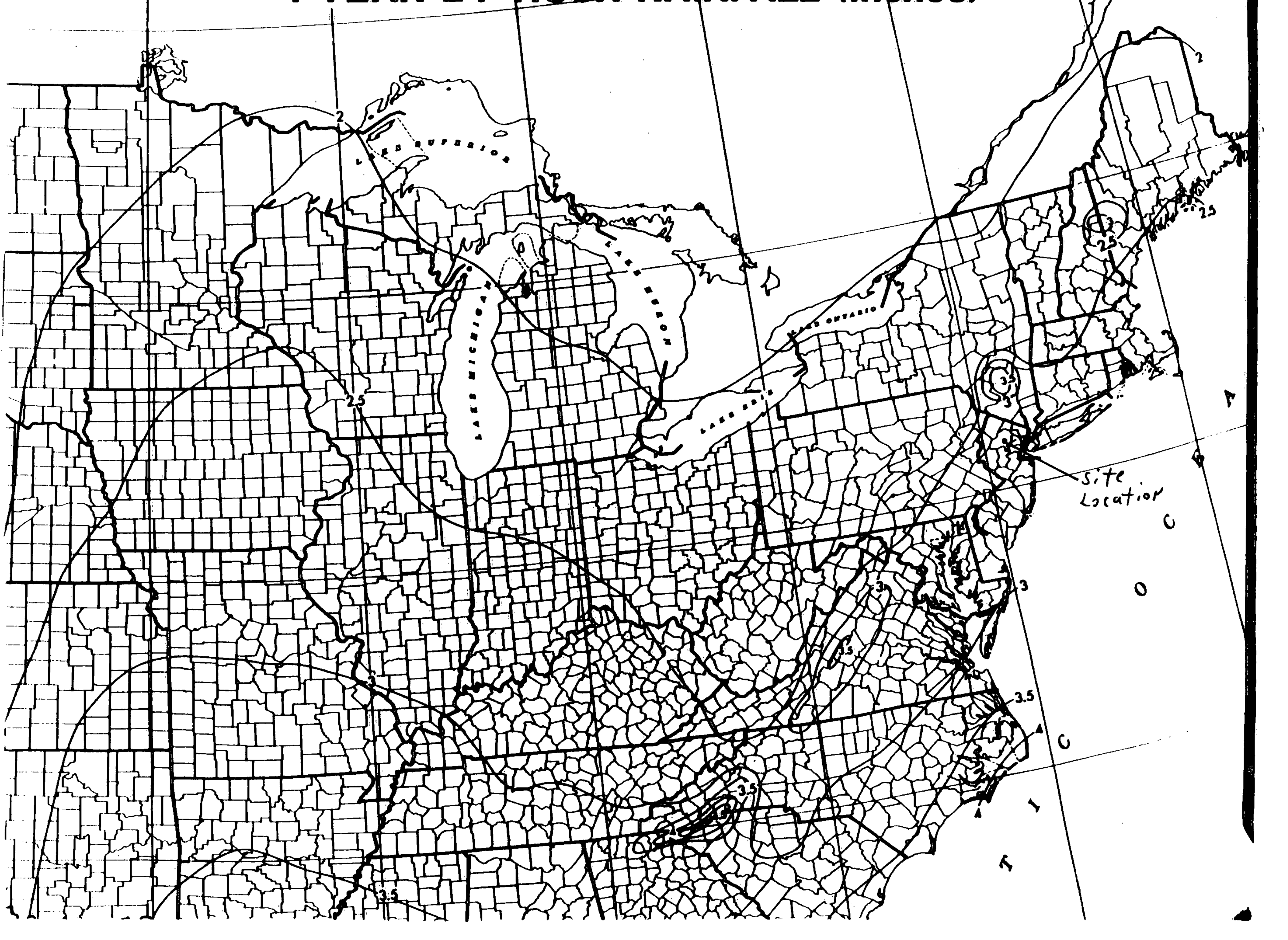


MEAN ANNUAL LAKE EVAPORATION (In Inches)



Based on period 1946-55

1 YEAR 24-HOUR RAINFALL (inches)



REFERENCE NO. 14

NUS CORPORATION TELECON NOTE

CONTROL NO:	DATE:	TIME:
02-8902-16	3/15/89	0830

DISTRIBUTION:

Oxy Process Chemicals
Morristown, NJ

BETWEEN:	OF:	PHONE:
Peter Badaicho	Morristown Water Dept	(201) 538 5600

AND: John Harrison NUS Corp. Edison, N.J (NUS)

DISCUSSION:

I talked with Peter Badaicho of the Morristown Water Dept regarding public supply wells and interconnecting water systems. He informed me that the East Hanover Water Dept, located approx 3 miles from site, to the northeast connects with the Morristown Water system. He informed me that the Sand Springs well which is approx 1/2 mile from site, carries bulk of public water supply for that Southern region of Morristown. 3/15/89

ACTION ITEMS:

NUS 087 REVISED 0581

REFERENCE NO. 15

NUS CORPORATION
SUPERFUND DIVISION

PROJECT NOTES

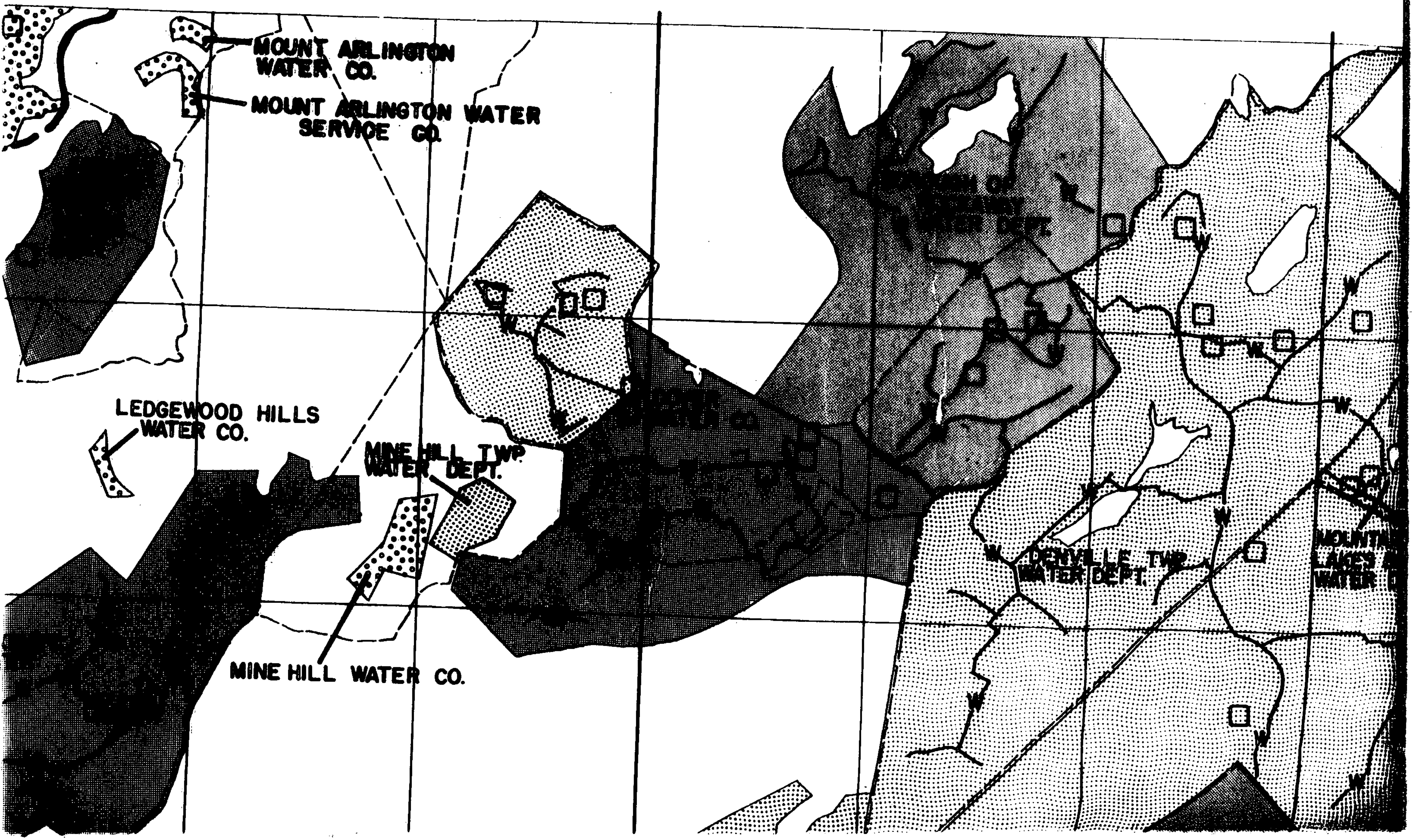
TO: Oxy Process Chemicals, Inc. P.A.
DATE: 3/17/89
FROM: Gary Rojek [signature]
COPIES:
SUBJECT: Location of Reference No. 15.
REFERENCE: Report No. 02-8902-16-PA, Rev. No. 0

Reference No. 15, the Three Mile Vicinity Map, is located in the back of the report, after reference number 20.

NUS 443A 58 1182

REFERENCE NO. 16

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DAVID J. BARDIN, COMMISSIONER



LEGEND

AREA SERVED BY PRIVATE WATER SERVICE COMPANIES

AREA SERVED BY REGIONALLY OWNED WATER SERVICE COMPANIES

AREA SERVED BY MUNICIPALLY OWNED WATER SERVICE COMPANIES

AREA NOT PRESENTLY SERVED BY WATER SERVICE

PUBLIC SUPPLY WELLS

SURFACE WATER INTAKE

W MAJOR WATER MAINS

WATER MAIN ACROSS HIGHWAY FOR FUTURE USE

TOWNSHIP BOUNDARIES

COUNTY BOUNDARIES

ALL MAP COORDINATES ARE FOR THE LOWER LEFT HAND CORNER

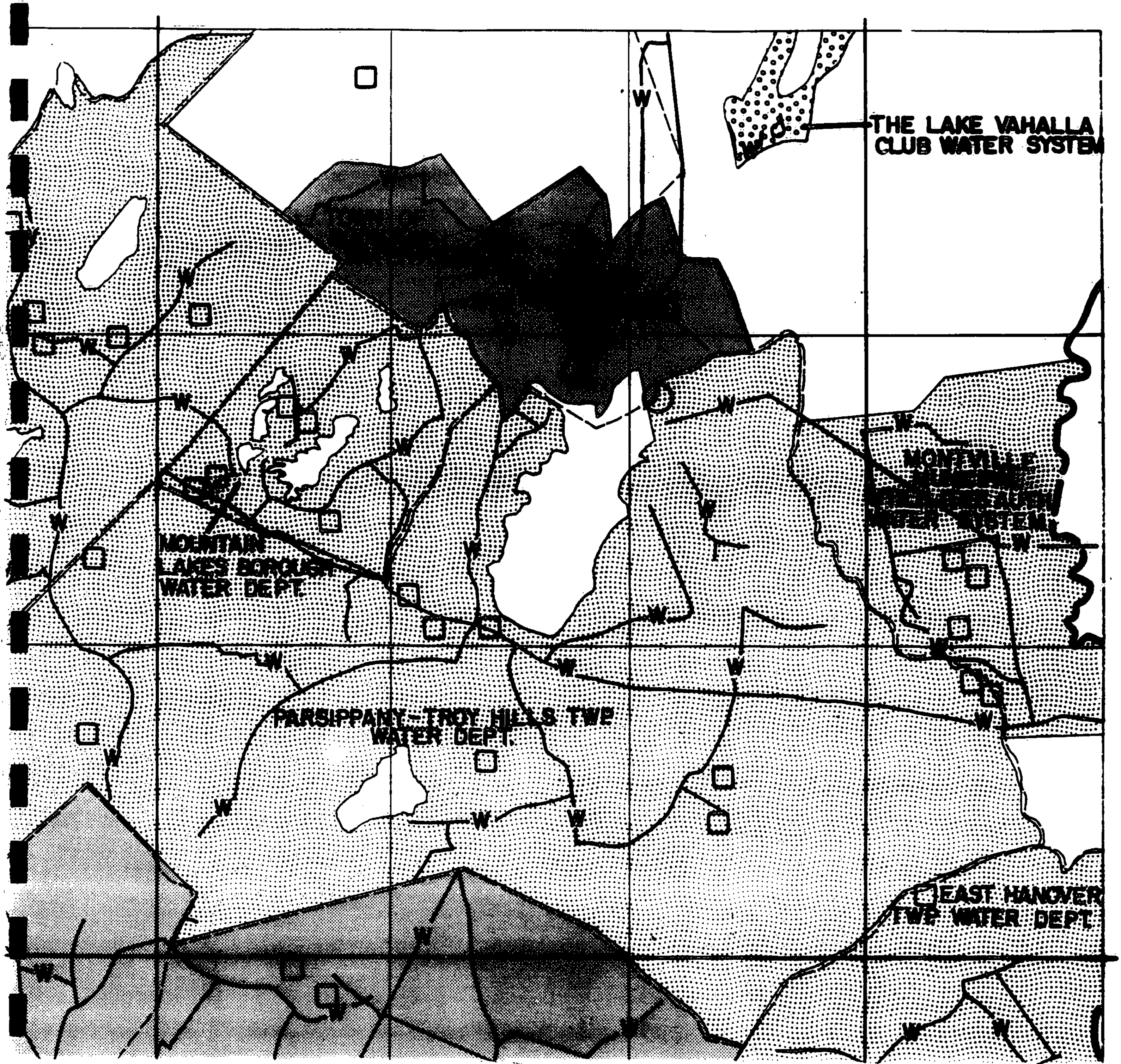
TION AND OWNERS OF PUBLIC SUPPLY WELLS

01-258	Boro of Stanhope
01-285	Boro of Stanhope
5-01-292	Boro of Stanhope
01-336	Lake Hopatcong Water Co.
01-478	West Jersey Water Service
5-01-528	Boro of Netcong
01-566	Boro of Netcong
02-112	Lake Hopatcong Water Co.
02-175	Short Hills Water Co.
5-02-379	Boro of Wharton
02-389	Boro of Wharton
02-397	Boro of Wharton
5-02-499	Roxbury Twp. Board of Education
639	Town of Dover
639	Town of Dover
696	Randolph Twp.

25-44-259	Twp. of Raritan
25-44-263	Twp. of Raritan
25-44-265	Twp. of Raritan
25-44-285	Twp. of Raritan
25-44-295	Twp. of Raritan
25-44-342	Twp. of Raritan
25-44-344	Twp. of Raritan

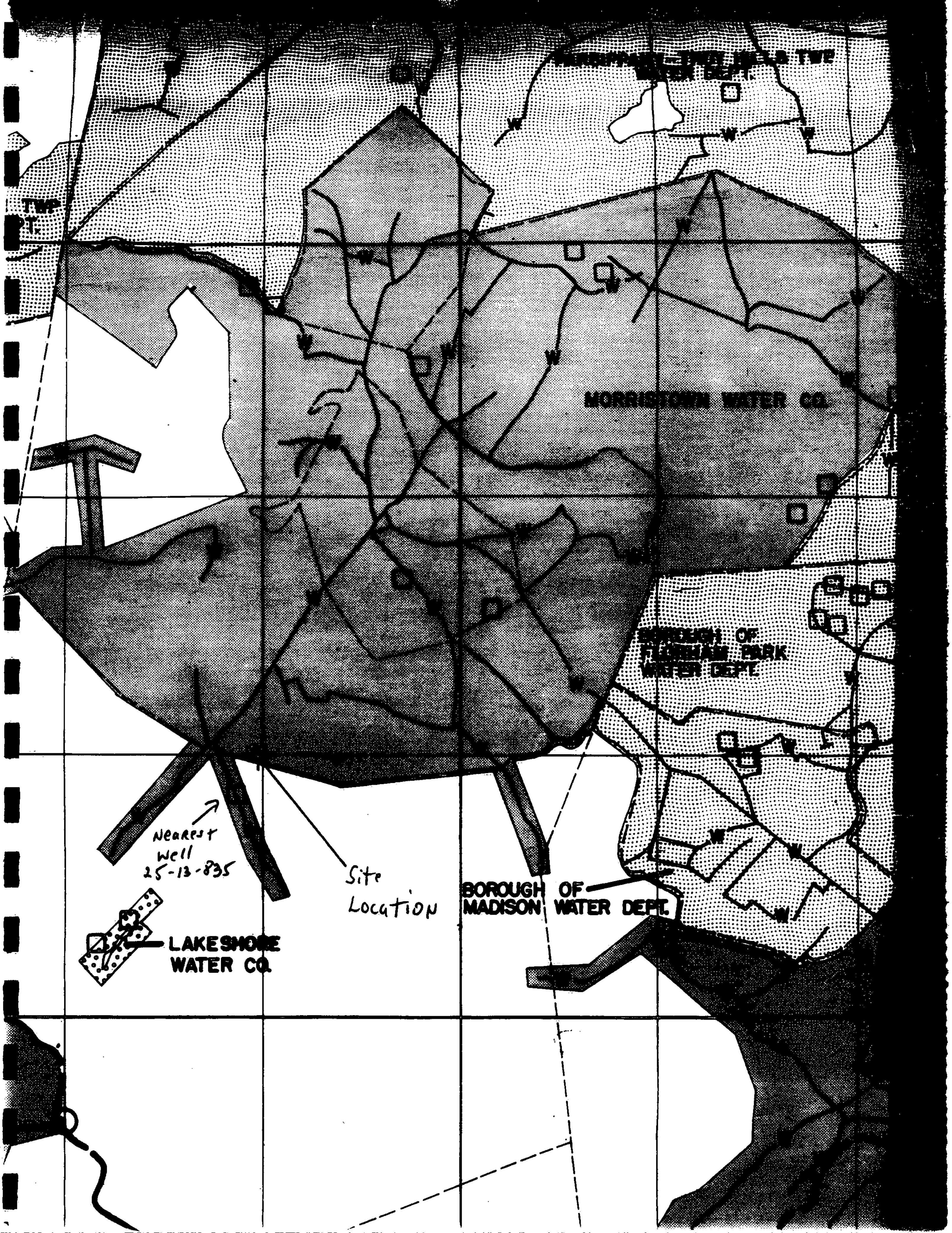
TION

WATER SUPPLY OVERLAY
SHEET 25



[illegible]	Town of Boonton
25-04-178	Boro of Mountain Lakes
25-04-429	Hillcrest Water Co.
25-04-429	Hillcrest Water Co.
25-04-445	Boro of Mountain Lakes
25-04-446	Boro of Mountain Lakes
25-04-467	Boro of Mountain Lakes
25-04-574	Twp. of Parsippany-Troy Hills
25-04-578	Twp. of Parsippany-Troy Hills
25-04-587	Twp. of Parsippany-Troy Hills
25-04-851	Twp. of Parsippany-Troy Hills
25-04-951	Twp. of Parsippany-Troy Hills
25-04-957	Twp. of Parsippany-Troy Hills
25-05-481	Twp. of Montville
25-05-485	Pine Brook Water Co.
25-05-487	Twp. of Montville
25-05-724	Twp. of Parsippany-Troy Hills
25-05-725	Twp. of Parsippany-Troy Hills
25-05-776	Twp. of East Hanover
25-11-196	West Morris Regional High School
25-11-231	Louis DeLotto
25-11-233	Budd Lake Water Co.
25-12-266	City of Morristown
25-12-836	Boro of Mendham
25-13-118	Twp. of Randolph
25-13-134	Twp. of Randolph
25-13-236	City of Morristown
25-13-317	City of Morristown
25-13-365	City of Morristown
25-13-637	City of Morristown
25-13-835	City of Morristown — Nearest well, USGS No. 270158, Sand Springs.
25-13-857	Lakeshore Water Co.
25-13-872	Lakeshore Water Co.
25-14-123	City of Morristown
25-14-131	City of Morristown
25-14-298	City of Morristown
25-14-348	Twp. of East Hanover
25-14-349	Twp. of East Hanover
25-14-442	Morristown Water Co.
25-14-517	City of Morristown
25-14-531	City of Morristown
25-14-563	Boro of Florham Park
25-14-565	Boro of Florham Park
25-14-566	Boro of Florham Park
25-14-587	Boro of Madison
25-14-629	Boro of Florham Park
25-14-634	Boro of Florham Park
25-14-641	Boro of Florham Park
25-14-822	Boro of Madison
25-15-155	Hanover Greens Water Co.
25-15-183	Twp. of Livingston
25-15-413	Twp. of Livingston
25-15-426	Twp. of Livingston
25-15-434	Twp. of Livingston
25-15-462	Twp. of Livingston
25-15-726	East Orange Water Department
25-15-727	East Orange Water Department
25-15-729	East Orange Water Department
25-15-766	East Orange Water Department
25-15-768	East Orange Water Department
25-15-783	Commonwealth Water Co.
25-21-336	Boro of Peapack-Gladstone
25-22-179	Boro of Peapack-Gladstone
25-23-126	Bernards Water Co.
25-23-675	Stirling Water Supply Co.
25-23-961	Watchung Hills Regional H. S.

25-33-771	[illegible]
25-44-175	City of New Bru[illegible]
25-44-189	Middlesex Water Co
25-44-556	City of New Brunsw[illegible]


MORRISTOWN WATER CO.
BOROUGH OF FLORHAM PARK WATER DEPT.
BOROUGH OF MADISON WATER DEPT.
LAKESHORE WATER CO.
Nearest well 25-13-835
Site Location

Scale: 1:63,360

SUPERVISED BY GEORGE J. HALASI-KUN, TOPOGRAPHIC ENGINEER
DRAFTED BY JOHN F. OLSCHEWSKI

REFERENCE NO. 17

PRELIMINARY ASSESSMENT
OFF SITE RECONNAISSANCE
INFORMATION REPORTING FORM

Date: 2/20/89

Site Name: Oxy Process Chemicals Inc TDD: 02-8902-16

Site Address: 350 Mt. Kemble Ave.
Street, Box, etc.

Morristown
Town

Morris
County

New Jersey
State

NUS Personnel:

Name	Discipline
Valerie Matthers	Soil Scientist
David Grupp	Biologist

Weather Conditions (clear, cloudy, rain, snow, etc.):
35-40°F; cloudy; little or no wind

Estimated wind direction and wind speed: calm

Estimated temperature: 35-40°F

Signature: Valerie A. Matthers Date: 2/20/89

Countersigned: [signature] Date: 2/21/89

PRELIMINARY ASSESSMENT

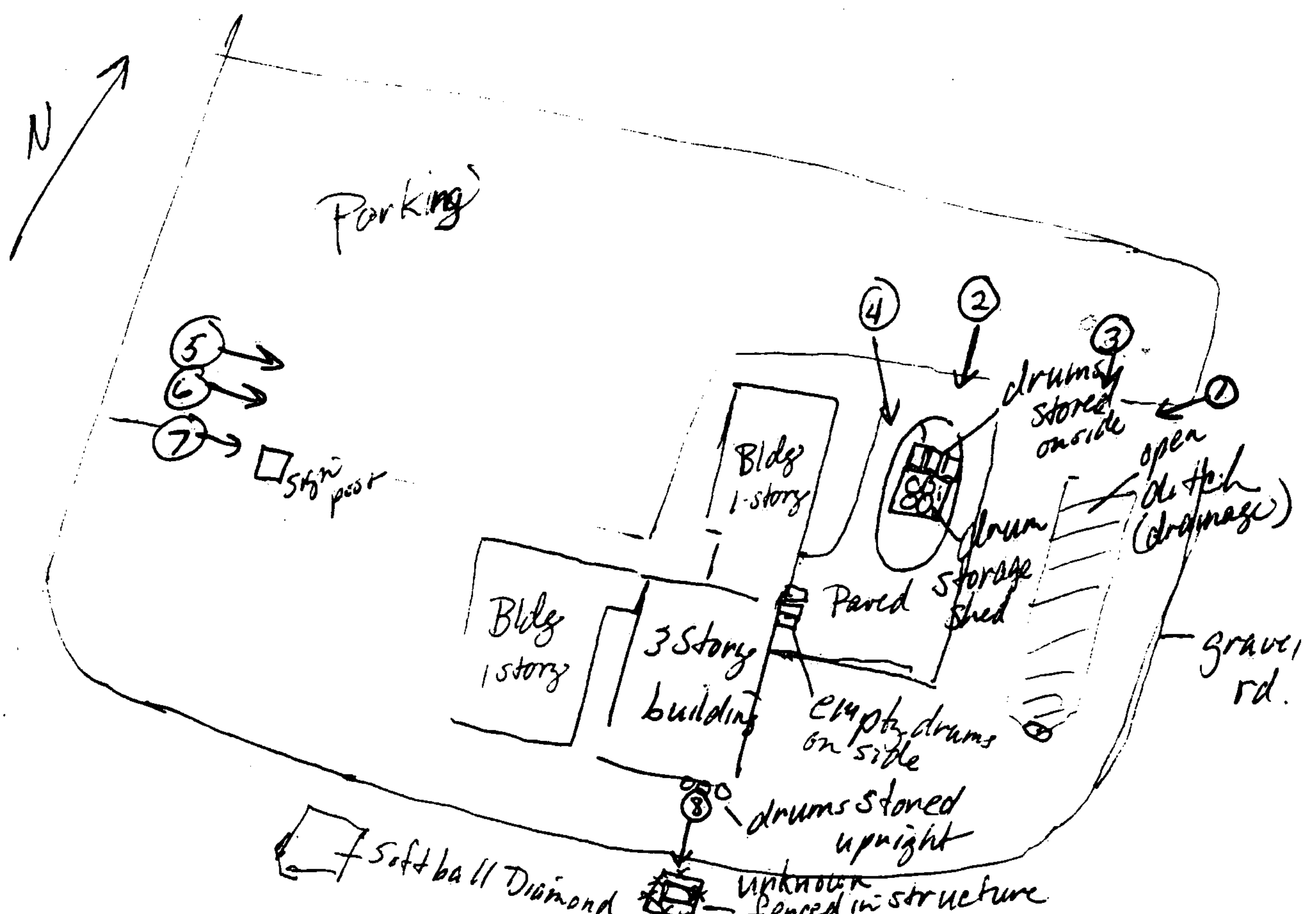
INFORMATION REPORTING FORM

Date: 2/20/89

Site Name: O+Y Process Chemical, Inc. TDD: 02-8902-16

Site Sketch:

Indicate relative landmark locations (streets, buildings, streams, etc.). Provide locations from which photos are taken.



Signature:

Date: 2/20/89

Countersigned:

Date: 2/21/89

PRELIMINARY ASSESSMENT

INFORMATION REPORTING FORM

Date: 2/20/89

Site Name: Oxy Process Chemicals, Inc. TDD: 02-8902-16

Notes (Periodically indicate time of entries in military time): 10:15 Arrived at Site. The facility is currently owned by Henkel but is for lease indicating that it is inactive. ~~In what~~ VAM In the area that was previously described as the solvent storage area there are about 15-20 drums stacked on their sides - appear to be empty and in good condition. At the loading dock of the site's 3-story building there are an additional 10-15 drums

Drainage Ditch on East side of property behind Solvent Storage Area before gravel road. Site is largely flat otherwise

Solvent Storage area is a shed - corregated ~~s~~ steel, fenced, locked gate - open on 2 sides. Storage pad is curbed and cement base. More drums could be seen standing upright here - number unknown.

On South Side of gravel road there is a softball field. At the southern or southeastern border of the ~~fi~~ VAM there was an unidentifiable structure surrounded by chain link fence.

No spills were observed. More drums, 5-10, were seen behind the 3-story building.

Directions: to get to site enter from Mt. Kemble Rd. at

Signature: Valerie A. Walker Date: 2/20/89
Countersignature: [signature] Date: 2/21/89

PRELIMINARY ASSESSMENT

INFORMATION REPORTING FORM

Date: 2/20/89

Site Name: Oxy Plexess Chemicals, Inc. TDD: 02-8902-16

Notes (Cont'd):

the entrance for AT&T (340 Mt. Kemble Rd) & continue to the very rear buildings that can be seen behind AT&T complex.

10:35 — Left Site.

AT&T est'd. 300 employee

Attach additional sheets if necessary. Provide site name, TDD number, signature, and countersignature on each.

Signature: Valerie A. Mathers Date: 2/20/89

Countersignature: [signature] Date: 2/21/89

PRELIMINARY ASSESSMENT

INFORMATION REPORTING FORM

Date: 2/20/89

Site Name: Oxy Process Chemicals, Inc. TDD: 02-8902-16

Photolog:

Frame/Photo Number	Date	Time	Photographer	Description
15-1/1P-1	2/20/89	10:20	D. Grupp	S.W. Direction – Solvent Storage Area
15-2/1P-2	2/20/89	10:20	D. Grupp	S. Direction – Loading Dock & Background
15-3/1P-3	2/20/89	10:23	D. Grupp	S. Direction – Drainage Ditch between
15-4/1P-4	2/20/89	10:24	D. Grupp	Drums in Solvent Storage Area
15-5/1P-5	2/20/89	10:27	D. Grupp	Direction – South East –
15-6/1P-6	2/20/89	10:27	D. Grupp	Pictures of buildings fr. Western Border ~~Sign Post of Henke~~ " " "
15-7/1P-7	2/20/89	10:30	D. Grupp	Sign Post of Henke / ~~Sign Post of H~~ VAM
15-8/1P-8	2/20/89	10:31	D. Grupp.	Unknown fenced in structure @ Southern Border

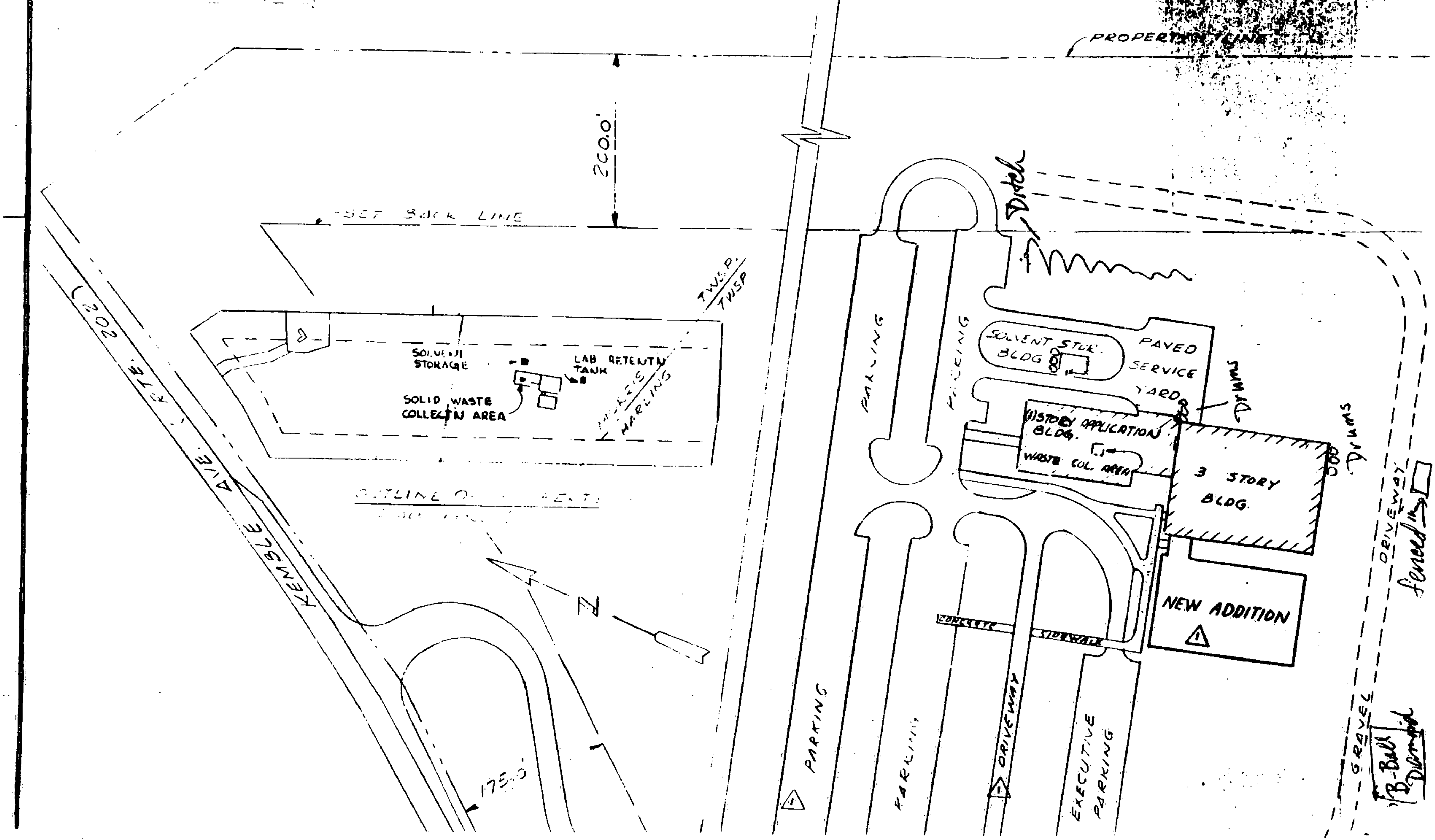
Attach additional sheets if necessary. Provide site name, TDD number, signature, and countersignature on each.

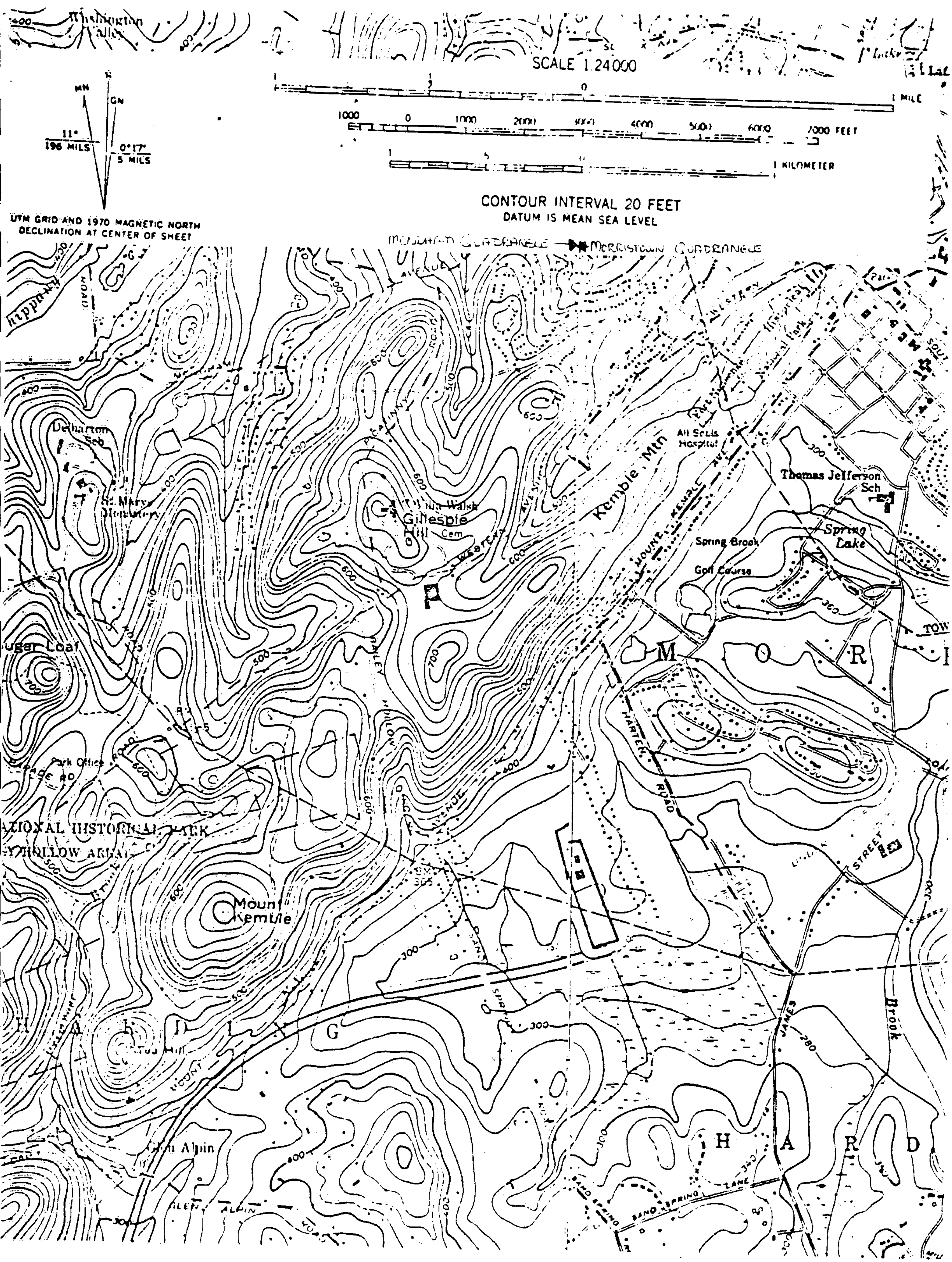
Signature: Valerie Mathews Date: 2/20/89

Countersignature: D. Grupp Date: 2/21/89

Continued from page 4

V. FACILITY DRAWING (see page 4)




SCALE 1:24000
1 MILE
7000 FEET
1 KILOMETER
CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL
UTM GRID AND 1970 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
MN
GN
11°
196 MILS
0°17'
5 MILS
MENDHAM QUADRANGLE
MORRISTOWN QUADRANGLE
Kemble Mtn
All Souls Hospital
Thomas Jefferson Sch
Spring Brook
Golf Course
Spring Lake
Gillespie Hill
Cem
Sugar Loaf
Park Office
Mount Kemble
Glen Alpin
M O R
H A R D
Brook
JAMES
MOUNT KEMBLE AVE
HARTER ROAD
SAND SPRING LANE
GLEN ALPIN ROAD
CONTOUR INTERVAL 20 FEET

REFERENCE NO. 18

40074-A1-EI-250

Newark

N. J.—N. Y.—PA.

69-835- -
GEOSTAT MAP & TRAVEL CENTERS
11 $ 4.95

1:250 000-scale map of

Atlantic Coast Ecological Inventory

Produced by
U. S. FISH AND WILDLIFE SERVICE
1980

TERRESTRIAL ORGANISMS

Shown in BROWN; species with special status shown in RED-(F) or (S) indicates species protected by Federal or State Legislation (see text)

SYMBOL SPECIES

PLANTS (301-350)
301 Eastern hemlock
302 Spleenwort (S)
303 Spider lily (S)
304 Pond bush (S)
305 Watermilfoil (S)
306 Hooded pitcher plant (S)
307 Tree
308 Prickly pear cactus (S)
309 Trailing arbutus (S)
310 Eastern bumelia
311 Pitcher plant
312 Baldcypress
313 Redbay
314 Seaside alder
315 Box huckleberry
316 Purple fringeless orchid
317 Pink lady's slipper
318 Ebony spleenwort (S)
319 Orchids (S)
320 Golden club (S)
321 Florida beargrass
322 East-coast coontie
323 Fall-flowering ixia
324 Jackson-vine
325 Spoon-flower
326 Curtiss milkweed
327 Sea lavender
328 Hand fern
329 Needle palm
330 Yellow squirrel-banana
331 Beach creeper
332 Florida coontie
333 Four-petal pawpaw
334 Bird's nest spleenwort
335 Burrowing four-o'clock
336 Beach star
337 Silver palm
338 Dancing lady orchid
339 Tamarindillo
340 Fuch's bromeliad
341 Everglades peperomia
342 Buccaneer palm
343 Slender spleenwort
344 Pineland jacquemontia
345 Mahogany mistletoe
346 Florida thatch
347 Twisted air plant
348 Long's bittercress
349 Venus's flytrap

INVERTEBRATES (351-400)
351 Monarch butterfly
352 Zebra butterfly

BIRDS (401-600)

SHOREBIRDS (401-430)
401 Shorebirds
402 Terns
403 Gulls
404 Forster's tern
405 Arctic tern
406 Least tern (S)
407 Roseate tern (S)
408 Common tern
409 Great black-backed gull
410 Herring gull
411 Laughing gull
412 Black skimmer (S)
413 Turnstones
414 Plovers
415 Piping plover
416 American oystercatcher (S)

WADING BIRDS (431-460)
431 Wading birds
432 Herons
433 Egrets
434 Rails
435 Ibises
436 Bitterns
437 Great blue heron (S)
438 Wood ibis (S)
439 Anhinga
440 Little blue heron (S)
441 Yellow-crowned night heron (S)
442 Black-crowned night heron
443 Florida sandhill crane (S)
444 Louisiana heron (S)
445 Limpkin (S)
446 Roseate spoonbill (S)
447 Snowy egret (S)
448 Magnificent frigate-bird (S)
449 Reddish egret (S)
450 Clapper rail
451 King rail
452 Virginia rail
453 Sora rail

WATERFOWL (461-500)
461 Waterfowl
462 Swans
463 Geese
464 Dabbling ducks
465 Diving ducks
466 Common eider
467 Harlequin duck
468 Wood duck
469 [illegible]
470 Loons
471 Grebes
472 Brant geese
[illegible]

AQUATIC ORGANISMS

Shown in BLUE; species with special status shown in RED(F) or (S) indicates species protected by Federal or State Legislation (see text)

SYMBOL SPECIES

[illegible]

LEGEND

POPULATED PLACES

Over 500,000 BOSTON

100,000 to 500,000 RICHMOND

25,000 to 100,000 EVANSTON

5,000 to 25,000 Hialeah

1,000 to 5,000 Bar Harbor

Less than 1,000

RAILROADS Single track Double or Multiple

Normal gauge

Narrow gauge

BOUNDARIES

International

State

County

Park or reservation

Mine

Spot elevation in feet

Landplane airport

Landing area

Seaplane airport

Seaplane anchorage

Power line

Woods-brushwood

ROADS

Primary, all-weather, hard surface

Secondary, all-weather, hard surface

Light-duty, all-weather, improved surface

Fair or dry weather, unimproved surface

Trail

Interchange

Route markers: Interstate, U.S., State

Landmark School, Church, Other

Depth curve in feet

Limit of danger Reef

Rocks Awash

Foreshore flat Mud

Intermittent or dry stream

Marsh or swamp

Scale 1:250,000

5 0 5 10 15 20 Statute Miles

5 0 5 10 15 20 25 30 Kilometers

5 0 5 10 15 Nautical Miles

TRANSVERSE MERCATOR PROJECTION

BLACK NUMBERED LINES INDICATE THE 10,000 METER UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 18

FOR SALE BY U. S. GEOLOGICAL SURVEY, RESTON, VIRGINIA 22092, OR DENVER, COLORADO 80225

[redacted]

1980

AQUATIC ORGANISMS

Shown in BLUE; species with special status shown in RED(F) or (S) indicates species protected by Federal or State Legislation (see text)

SYMBOL SPECIES

PLANTS (1-50)
1 Irish moss
2 Rockweed

INVERTEBRATES (51-100)
51 Crabs
52 Mussels
53 Oysters
54 Scallops
55 Clams
56 Worms
57 Shrimp
58 American lobster
59 Blue crab
60 Eastern oyster
61 European oyster
62 Bay scallop
63 Deep-sea scallop
64 Calico scallop
65 Surf clam
66 Hard clam
67 Soft shell clam
68 Brackish water clam
69 Bloodworm
70 Sandworm
71 White shrimp
72 Brown shrimp
73 Northern shrimp
74 Rock crab
75 [illegible] crab
76 [illegible]
77 [illegible]
78 [illegible] shrimp
79 [illegible]
80 [illegible] oyster

FISH (101-200)
101 Sharks, skates, rays
102 Herring
103 Salmon and trout
104 Catfish
105 [illegible]
106 Sunfish and bass
107 [illegible]
108 [illegible]fish
109 Longnose gar
110 Shortnose sturgeon (F)
111 Atlantic sturgeon (S)
112 American eel
113 Blueback herring
114 Hickory shad
115 Alewife
116 American shad (S)
117 Atlantic menhaden
118 Atlantic herring
119 Gizzard shad
120 Tarpon
121 Atlantic salmon
122 White catfish
123 Channel catfish
124 Yellow bullhead
125 Brown bullhead
126 Flat bullhead
127 Sea catfish
128 White perch
129 Striped bass
130 Black sea bass
131 Redbreast sunfish
132 Warmouth
133 Bluegill
134 Largemouth bass
135 Black crappie
136 Sheepshead
137 Spotted seatrout
138 Weakfish
139 Spot
140 Atlantic croaker
141 Southern kingfish
142 Northern kingfish
143 Gulf kingfish
144 Red drum
145 Star drum
146 Black drum
147 Summer flounder
148 Southern flounder
149 Winter flounder
150 Rainbow smelt
151 Atlantic tomcod
152 Threadfin shad
153 Carp
154 Atlantic mackerel
155 Chain pickerel
156 White bass
157 Northern puffer
158 Silver perch
159 Florida pompano
160 Bluefish
161 Spanish mackerel
162 Cobia
163 Mullet
164 White crappie
165 Redear sunfish
166 Smallmouth bass
167 Yellow perch
168 Pumpkinseed
169 Atlantic halibut
170 Atlantic cod
171 Pollock
172 Haddock
173 Hake
174 Bluefin tuna
175 [illegible]
176 [illegible] pike
177 Scup
178 Tautog
179 Atlantic spadefish
180 Bay anchovy
181 Butterfish
182 Little tunny
183 Atlantic bonito
184 Brown trout
185 Cunner
186 Yellowtail flounder
187 Gulf flounder
188 Pinfish
189 King mackerel
190 Pigfish
191 White grunt
192 Tripletail
193 Ladyfish
194 Snook
195 Jack
196 Snapper
197 Grouper
198 [illegible]fish
199 Great barracuda
200 Maryland darter (F)

REPTILES AND AMPHIBIANS (201-250)
201 Green sea turtle (F)
202 Loggerhead sea turtle (F)
203 Hawksbill turtle (F)
204 Atlantic ridley turtle (F)
205 Leatherback turtle (F)

MAMMALS (251-300)
251 Florida manatee (F)
252 Atlantic bottlenose dolphin
253 Pygmy sperm whale
254 Short finned pilot whale
255 Harbor seal
256 Gray seal
257 Right whale (F)
258 Atlantic spotted dolphin

High salinity estuarine habitat (generally 16.5 to 30 parts per thousand). Arrows used for wide estuaries.

Mid salinity estuarine habitat (generally 5 to 16.5 parts per thousand).

Low salinity estuarine habitat (generally 0.5 to 5 parts per thousand) and tidal freshwater.

Non-tidal freshwater riverine and creek habitat

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310 Eastern bumelia
311 Pitcher plant
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313 Redbay
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439 Anhinga
440 Little blue heron (S)
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443 Florida sandhill crane (S)
444 Louisiana heron (S)
445 Limpkin (S)
446 Roseate spoonbill (S)
447 Snowy egret (S)
448 Magnificent frigate-bird (S)
449 Reddish egret (S)
450 Clapper rail
451 King rail
452 Virginia rail
453 Sora rail

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463 Geese
464 Dabbling ducks
465 Diving ducks
466 Common eider
467 Harlequin duck
468 Wood duck
469 Fulvous tree duck
470 Loons
471 Grebes
472 Brant geese
473 Snow goose
474 [illegible]
475 [illegible] duck

RAPTORS (501-530)
501 Raptors
502 Owls
503 Kites
504 Hawks
505 Bald eagle (F)
506 Osprey [illegible]
507 Peregrine falcon (F)
508 Cooper's hawk (S)
509 Swallow tailed kite
510 Marsh hawk (S)
511 Southeastern American kestrel (S)
512 Florida burrowing owl (S)

SEABIRDS (531-550)
531 Seabirds
532 Petrels, shearwaters, and albatrosses
533 Pelican and allies
534 Alcids
535 Brown pelican (F)
536 Black guillemot
537 Leach's petrel
538 Razorbill
539 Common puffin
540 Double crested cormorant
541 Gannet
542 Wilson's petrel
543 Northern phalarope
544 Audubon's shearwater
545 Greater shearwater
546 Shearwaters
547 Petrels
548 Jaegers
549 White pelican

SONGBIRDS AND OTHERS (551-600)
551 Songbirds and others
552 Red cockaded woodpecker (F)
553 Chachalaca
554 Bachman's warbler (F)
555 Wild turkey
556 American woodcock
557 Pileated woodpecker
558 Swainson's warbler
559 Ruffed grouse
560 Bobwhite
561 Mourning dove
562 Warblers
563 Ring necked pheasant
564 Bank swallow
565 Dusky seaside sparrow (F)
566 White crowned pigeon (S)

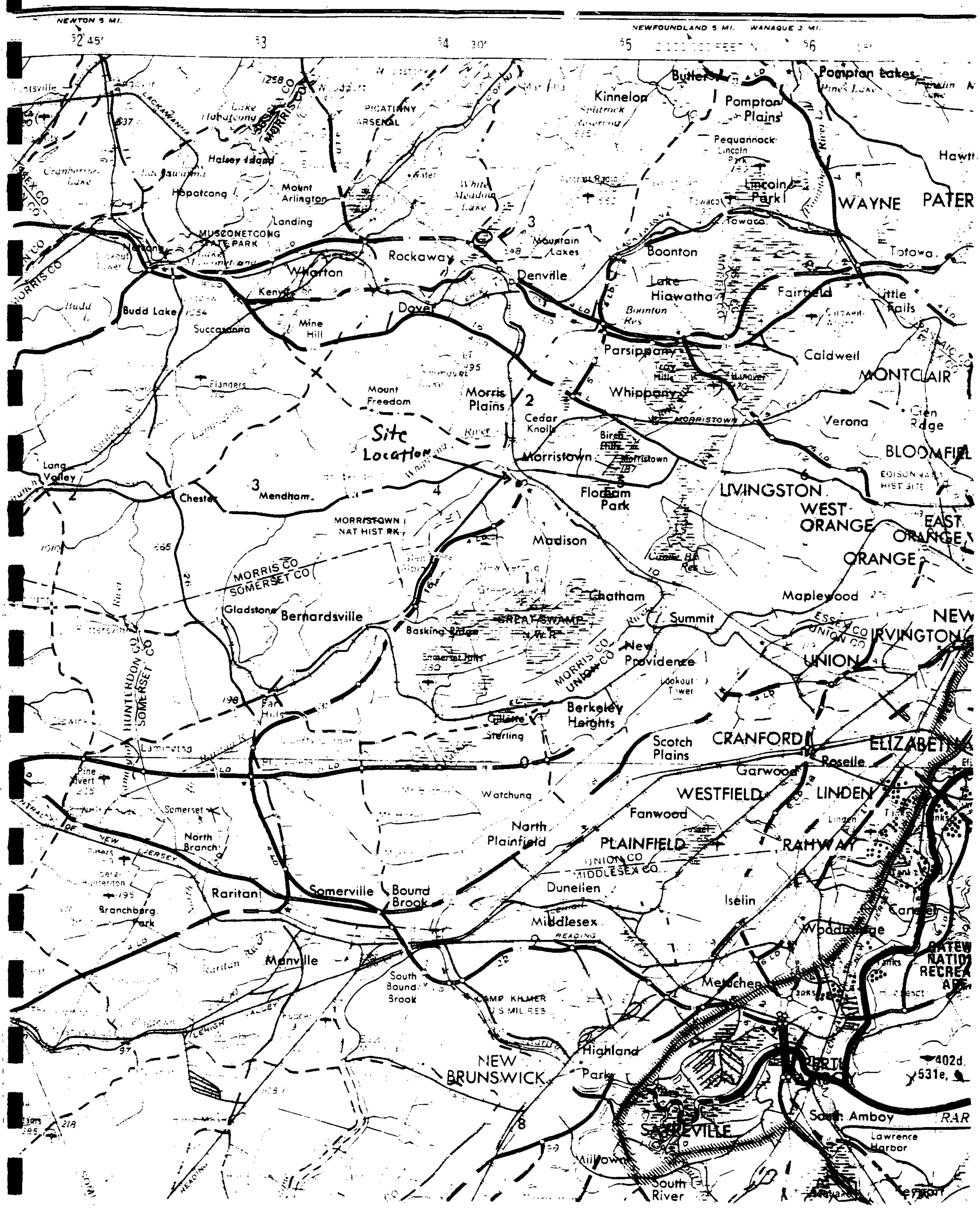
REPTILES AND AMPHIBIANS (601-700)
601 Eastern narrow-mouthed toad (S)
602 Eastern indigo snake (F)
603 American alligator (F)
604 Northern diamondback terrapin
605 Amphibians
606 Greater siren
607 Bog turtle (S)
608 Gopher tortoise (S)
609 Eastern tiger salamander (S)
610 Northern fence lizard
611 Five lined skink
612 Map turtle
613 Plymouth red-bellied turtle (F)
614 Eastern diamondback rattlesnake
615 Carolina gopher frog
616 Florida gopher frog (S)
617 Atlantic salt marsh watersnake (F)
618 American crocodile (F)
619 Florida Keys mole skink (S)
620 Florida black-headed snake (S)
621 Pine barrens tree frog (S)
622 Northern pine snake (S)
623 Corn snake (S)
624 Timber rattlesnake (S)
625 Southern gray tree frog (S)

MAMMALS (701-800)
701 Beaver
702 Whitetail deer
703 European fallow deer
704 Blackbeard Island deer
705 Opossum
706 Marsh rabbit
707 Rice rat
708 Raccoon
709 St. Simon Island raccoon
710 Mink
711 River otter (F)
712 Feral hog
713 Feral cow
714 Cumberland Island pocket gopher
715 Anastasia Island cotton mouse
716 Aquatic furbearers
717 Black bear (S)
718 Bobcat
719 Eastern gray squirrel
720 Eastern fox squirrel
721 Eastern cottontail
722 Delmarva fox squirrel (F)
723 Muskrat
724 Red fox
725 Bats
726 Gray fox
727 Striped skunk
728 Nutria
729 Longtail weasel
730 Colonial pocket gopher (S)
731 Wild horses
732 Sika deer
733 Beach meadow vole
734 Block Island meadow vole
735 [illegible] beach mouse (S)
736 Sherman's fox squirrel (S)
737 Florida mouse (S)
738 Florida panther (F)
739 [illegible] pocket gopher (S)
740 Key Largo woodrat (S)
741 Lower Keys cotton rat (S)
742 Key Largo cotton mouse (S)

HABITAT USE

Shown in RED for species with special status, BLUE for aquatic organisms and BROWN for terrestrial organisms

- Spawning ground
- Nursery
- Commercial harvesting area
- Adult concentration
- Overwintering area
- Sport fishing/hunting area
- Migratory area
- Nesting area
- Unusual distribution
- Specimen


NEWTON 5 MI.
NEWFOUNDLAND 5 MI.
WANAQUE 2 MI.
Site Location
Lake Hopatcong
MORRIS CO
PICATINNY ARSENAL
Kinnelon
Butler
Pompton Lakes
Pompton Plains
Pequannock
Lincoln Park
WAYNE
Halsey Island
Hopatcong
Mount Arlington
White Meadow Lake
Landing
MUSCONETCONG STATE PARK
Mountain Lakes
Boonton
Towaco
Totowa
Rockaway
Wharton
Denville
Lake Hiawatha
Fairfield
Little Falls
Budd Lake
Succasunna
Kenvil
Mine Hill
Dover
Boonton Res
Parsippany
Caldwell
MONTCLAIR
Flanders
Mount Freedom
Morris Plains
Cedar Knolls
Whippany
Troy Hills
Hanover
Verona
Glen Ridge
Morristown
Birch Hills
Florham Park
LIVINGSTON
BLOOMFIELD
Long Valley
Chester
Mendham
MORRISTOWN NAT HIST PK
WEST ORANGE
EAST ORANGE
ORANGE
Madison
MORRIS CO
SOMERSET CO
Gladstone
Bernardsville
Chatham
GREAT SWAMP N W R
Summit
Maplewood
Basking Ridge
New Providence
ESSEX CO
UNION CO
IRVINGTON
UNION
HUNTERDON CO
SOMERSET CO
Lookout Tower
Far Hills
Berkeley Heights
Gillette
Sterling
Scotch Plains
CRANFORD
ELIZABETH
Roselle
Pine Hill
Garwood
Watchung
WESTFIELD
LINDEN
Fanwood
Somerset
North Plainfield
PLAINFIELD
RAHWAY
North Branch
UNION CO
MIDDLESEX CO
Raritan
Somerville
Bound Brook
Dunellen
Iselin
Branchburg Park
Middlesex
Woodbridge
Manville
South Bound Brook
Metuchen
CAMP KILMER U S MIL RES
Highland Park
NEW BRUNSWICK
South Amboy
SAYREVILLE
Lawrence Harbor
Milltown
South River
READING
LEHIGH VALLEY
LACKAWANNA

REFERENCE NO. 19

Surface Water Classifications

Surface Water Quality Standards

State of New Jersey Department of Environmental Protection/Division of Water Resources

Classifications

Surface Water Quality Standards
N.J.A.C. 7:9-4

Index A

[illegible] Waters by [illegible] Within Basins

May 1985

[illegible] Department of Environmental Protection/Division of Water Resources

GUIDE TO USE OF INDEXES B THROUGH F

The Surface Water Classification Indexes give the surface water classifications for the waters of the State. The listing is divided into five indexes by major drainage basin: b) Atlantic Coastal; c) Delaware River; d) Passaic River, Hudson River, and New York Harbor Complex; e) Raritan River; and f) Wallkill River. Within each basin the waters are listed alphabetically and segment descriptions begin at the headwaters and proceed downstream.

a) To find a stream in this listing:

1. Determine which Major Basin the stream is in;

2. Look for the name of the stream in the appropriate index and find the classification;

3. For unnamed or unlisted streams, find the stream or other waterbody that the stream of interest flows into and look for the classification of that stream or waterbody. The classification of the stream of interest may then be determined by referring to c) below. If the second stream or waterbody is also unlisted, repeat the process until a listed stream or waterbody is found. Use c)1 through c)3 below to classify streams entering unlisted lakes.

b) To find a lake or other non-stream waterbody:

1. Determine which Major Basin the waterbody is in;

2. Look for the waterbody name in the appropriate index;

3. If the waterbody is not listed use c)2, c)5 and c)6 below to determine the appropriate classification.

c) To find unnamed waterways or waterbodies or named waterways or waterbodies which do not appear in the listing, use the following rules:

1. Unnamed or unlisted freshwater streams that flow into streams classified as FW2-TP, FW2-TM, or FW2-NT or lakes classified as FW2-NT take the classification of the waters they enter, unless the unlisted stream is a PL water (see 6 below). If the stream could be a C1 water also see 5 below.

2. All fresh water lakes, ponds and reservoirs that exceed one acre in surface area, are not located within the Pinelands Area boundaries (see 6 below) and are not specifically listed as FW2-TM are classified as FW2-NT. This includes impoundments on segments of streams which are classified as FW2-TM such as Saxton Lake on the Musconetcong River. If the waterbody could be a C1 water also check 5 below.

3. Unnamed or unlisted streams which enter FW2-TM lakes are classified as FW2-TM only if all of the listed streams in the watershed that flow into the lake are classified as FW2-TM and/or FW2-TP. If none of the streams that flow into the lake are listed, the stream of interest is classified as FW2-TM only if all of the outlet streams from the lake are classified as FW2-TM or FW2-TP. If the stream is located within the boundaries of the Pinelands Area see 6 below; if it could be a C1 water also see 5 below.

4. Unnamed or unlisted saline waterways and waterbodies are classified as SE1 in the Atlantic Coastal Basin. Unnamed or unlisted saline waterways which enter SE2 or SE3 waters in the Passaic, Hackensack and NY Harbor Complex basin are classified as SE2 unless specifically listed within Index d. Freshwater portions of unnamed or unlisted streams entering SE1, SE2 or SE3 waters are classified as FW2-NT. This only applies to waters that are not PL waters (see 6 below). If the waterbody or waterway could be a C1 water also see 5 below.

5. If the waterway or waterbody of interest flows through or is entirely located within State parks, forests or fish and game lands, Federal wildlife refuges, other special holdings, or is a State shellfish water as defined in N.J.A.C. 7:9-4, the Department's maps should be checked to determine if the waterbody of interest is mapped as a C1 water. If the waterway or waterbody does not appear on the USGS quadrangle that the Department used as a base map in its designation of the C1 waters, the Department will determine on a case-by-case basis whether the waterway or waterbody should be designated as C1.

6. All waterways or waterbodies, or portions of waterways and waterbodies that are classified as PL only for those portions that are located within the boundaries of the Pinelands Area are classified as PL unless they are listed as FW1 waters in Index A. A tributary entering a PL stream is classified as PL only for those portions of the tributary that are within the Pinelands Area. Lakes are classified as PL only if they are located entirely within the Pinelands Area.

CLASSIFICATIONS:

FW1
FW2-TP -- FW2 Trout Production
FW2-TM -- FW2 Trout Maintenance
FW2-NT -- FW2 Non Trout
PL -- Pinelands Waters
SE1
SE2
SE3
SC
FW2-NT/SE1 (or similar designation) -- Indicates a waterway in which there may be a salt water/fresh water interface. The exact point of demarcation between the fresh and saline waters must be determined by salinity measurements and is that point where the salinity reaches 3.5 parts per thousand at mean high tide. The stream is classified as FW2-NT in the fresh portions (salinity less than or equal to 3.5 parts per thousand at mean high tide) and SE1 in the saline portions.

DESIGNATIONS:

(C1) -- Category 1 waters
[tp] -- Indicates trout production in waters which are classified as FW1; this is for information only and does not affect the water quality criteria for any stream
[tm] -- Indicates trout maintenance in waters which are classified as PL or FW1. For FW1 this is for information only and does not affect the water quality criteria for any stream.

[illegible] Classifications

Surface Water Quality Standards

N.J.A.C. 7:9-4

[illegible]

[illegible] Water Classifications [illegible] Pass[illegible]

[illegible]ensack and [illegible] Harbor [illegible]ex Basin[illegible]

July 1985

State [illegible] New Jersey Department of Environmental Protection, [illegible] of Water Resources

DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES

Surface Water Quality Standards

Adopted:	August 7, 1985 by Robert E. Hughey, Commissioner, Department of Environmental Protection
Authority:	N.J.S.A. 13:1D-1 et seq., 58:10A-1 et seq., and 58:11A-1 et seq.
Effective Date:	September 3, 1985
Expiration Date pursuant to Executive Order No. 66 (1978):	May 20, 1990

DATE: 8/7/85

Robert E. Hughey
ROBERT E. HUGHEY, Commissioner
Department of Environmental Protection

COOLEY BROOK	
(W. Milford) - Entire length, except segments described below	FW2-TP(C1)
(Hewitt) - Segments of the brook and all tributaries located entirely within Hewitt State Forest	FW1 [tp]
CORYS BROOK (Warren) - Entire length	FW2-NT
CRESSKILL BROOK	
(Alpine) - Source to Duck Pond Rd. bridge, Demarest	FW2-TP(C1)
(Demarest) - Duck Pond Rd. bridge to Tenakill Brook	FW2-NT
CUPSAW BROOK	
(Skylands) - Source to Cupsaw Lake dam, except segment described below	FW2-NT
(Skylands) - That segment of Cupsaw Brook above the dam and within the boundaries of Ringwood State Park	FW2-NT(C1)
(Skylands) - Cupsaw Lake dam to mouth	FW2-TM
DEAD RIVER (Liberty Corners) - Entire length	FW2-NT
DEN BROOK (Denville) - Entire length	FW2-NT
DUCK POND (Ringwood)	FW2-NT(C1)
ELIZABETH RIVER	
(Elizabeth) - Source to Broad St. bridge, Elizabeth and all freshwater tributaries	FW2-NT
(Elizabeth) - Broad St. bridge to mouth	SE3
FOX BROOK (Mahwah) - Entire length	FW2-NT
GLASMERE POND (Ringwood)	FW2-NT(C1)
GOFFLE BROOK (Hawthorne) - Entire length	FW2-NT
GRANNIS BROOK (Morris Plains) - Entire length	FW2-NT
GREAT BROOK	
(Chatham) - Entire length, except segment described below	FW2-NT
(Great Swamp) - Segment within the boundaries of the Great Swamp National Wildlife Refuge	FW2-NT(C1)
GREEN BROOK	
(W. Milford) - Entire length, except those segments described below	FW2-TP(C1)
(Hewitt) - Those segments located entirely within the Hewitt State Forest boundaries	FW1 [tp]
GREEN POND (Rockaway)	FW2-TM
GREEN POND BROOK (Picatinny Arsenal) - Green Pond outlet to Rockaway River	FW2-NT
GREENWOOD LAKE (W. Milford)	FW2-TM
HACKENSACK RIVER	
(Oradell) - Source to Oradell dam	FW2-NT
(Oradell) - Main stem and saline tributaries from Oradell dam to the confluence with Overpeck Creek	SE1
(Little Ferry) - Main stem and saline tributaries from Overpeck Creek to confluence with Berrys Creek	SE2
(Secaucus) - Main stem from Berrys Creek to Route 1 & 9 crossing	SE2
(Kearny Point) - Main stem downstream from Route 1 & 9 crossing	SE3

REFERENCE NO. 20

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OXY PROCESS CHEMICAL
LATITUDE 40:45:13 LONGITUDE 74:30: 0 1980 POPULATION

KM	0.00-.400	.400-.810	.810-1.60	1.60-3.20	3.20-4.80	4.80-6.40	SECTOR TOTALS
S 1	0	1443	0	2827	6741	30480	41491
RING TOTALS	0	1443	0	2827	6741	30480	41491

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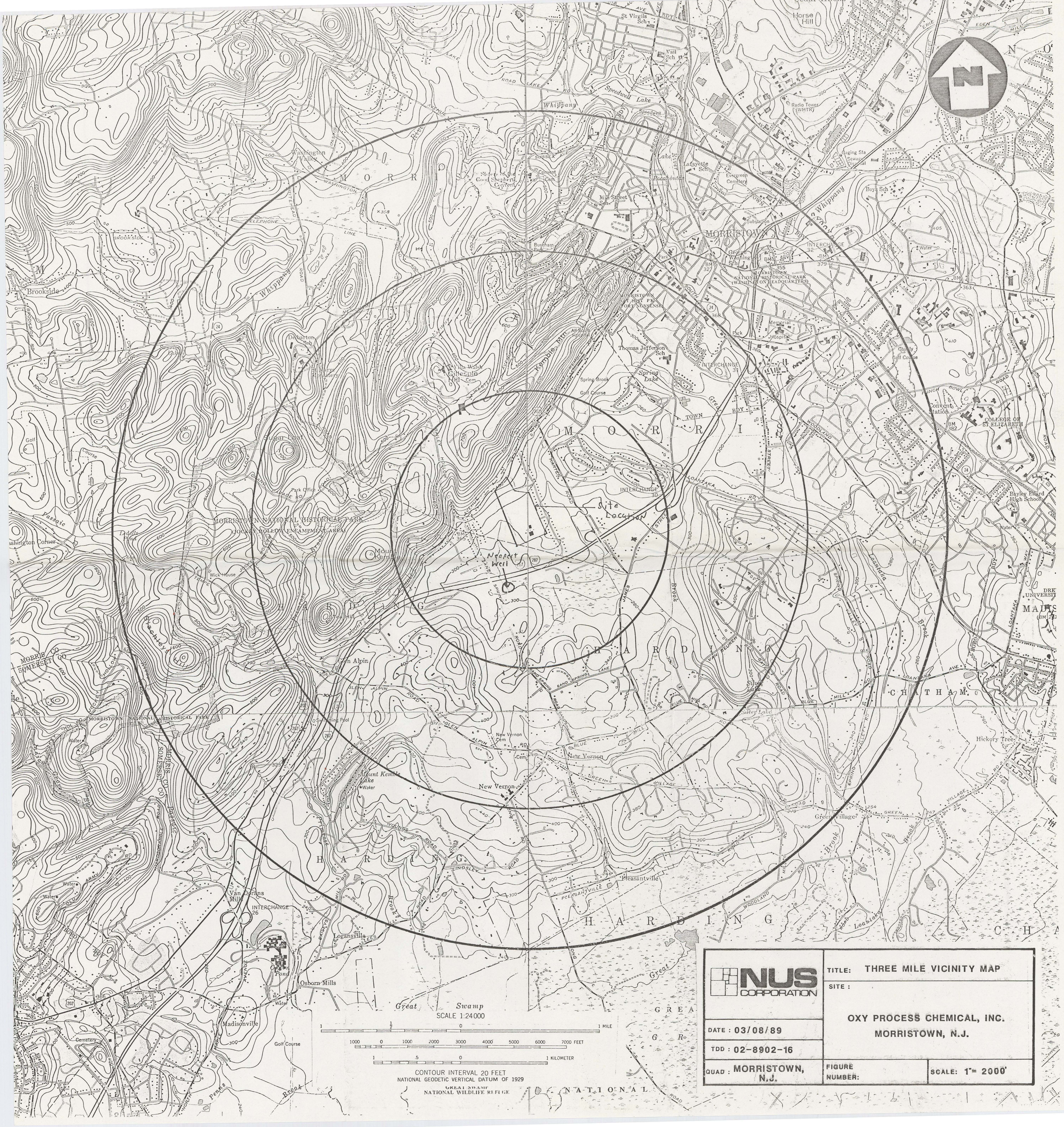
OXY PROCESS CHEMICAL
LATITUDE 40:45:13 LONGITUDE 74:30: 0 1980 HOUSING

KM	0.00-.400	.400-.810	.810-1.60	1.60-3.20	3.20-4.80	4.80-6.40	SECTOR TOTALS
S 1	0	477	0	988	2386	10406	14257
RING TOTALS	0	477	0	988	2386	10406	14257

Distance (mi.)	Population	Houses
1/4	0	0
1/2	1443	477
1	1443	477
2	4270	1465
3	11,011	3851
4	41,491	14,257



NUS CORPORATION	TITLE: THREE MILE VICINITY MAP	
	SITE : OXY PROCESS CHEMICAL, INC. MORRISTOWN, N.J.	
DATE : 03/08/89		
TDD : 02-8902-16		
QUAD : MORRISTOWN, N.J.	FIGURE NUMBER:	SCALE: 1"= 2000'